MONITORING OF IWMP WATERSHED PROJECTS USING GEO-INFORMATION

SUMMARY REPORT

IWMP-Batch-V

VISAKHAPATNAM -01/2013-14
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

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-01/2013-14, Visakhapatnam District of Andhra Pradesh. The total geographical area of the project is 8,049 ha. It comprises of 15 micro watersheds.
4. In the project area 10 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 1.90 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. 43 % is covered by the agriculture, 31 % is covered by forest, 18 % is covered by scrubland and remaining by other land use classes.

STUDY AREA
PROJECT : SANTHARI WATERSHED - IWMP-01/2013-14
DISTRICT : VISAKHAPATNAM , STATE : ANDHRA PRADESH

- The study area falls in Hukumpeta Mandal of Visakhapatnam district of Andhra Pradesh state. The total geographical area of the project is 8,179 ha. It comprises of 15 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.

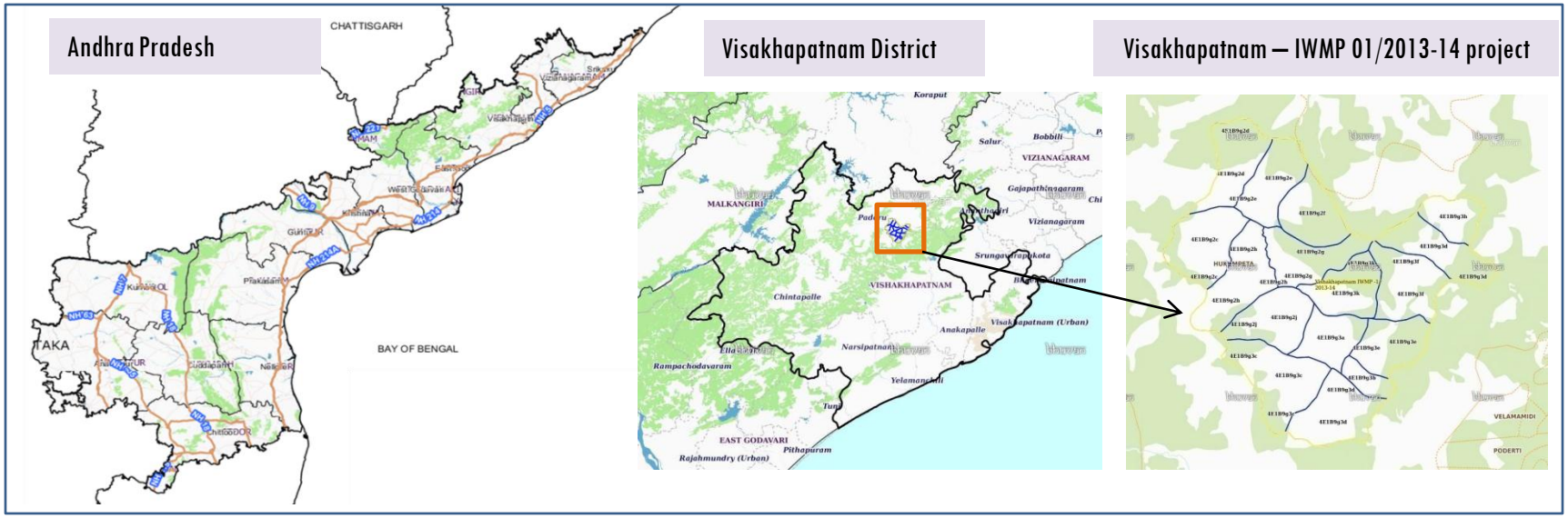


Fig.1. Location map of Santhari Watershed (IWMP-01/2013-14) in Visakhapatnam, A.P

- 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			21-Nov-22
SCENE2			
SCENE 3			
SCENE 4			
CARTO	2013-14		
SCENE 1			21-Nov-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	10
4	Detailed Project Report		

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

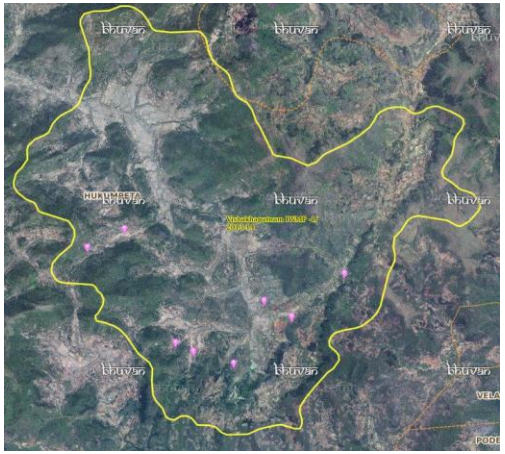
Legend

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	0	0
9	Gabion structure	0	0
10	Farm ponds/Dug out pit	0	0
11	Civil work-Check dams/Rock fill dam	0	0
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	10	10
18	Others	0	0
	TOTAL	**10**	**10**

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. Santhari Watershed (IWMP-01/2013-14) Natural Colour Composite (NCC)

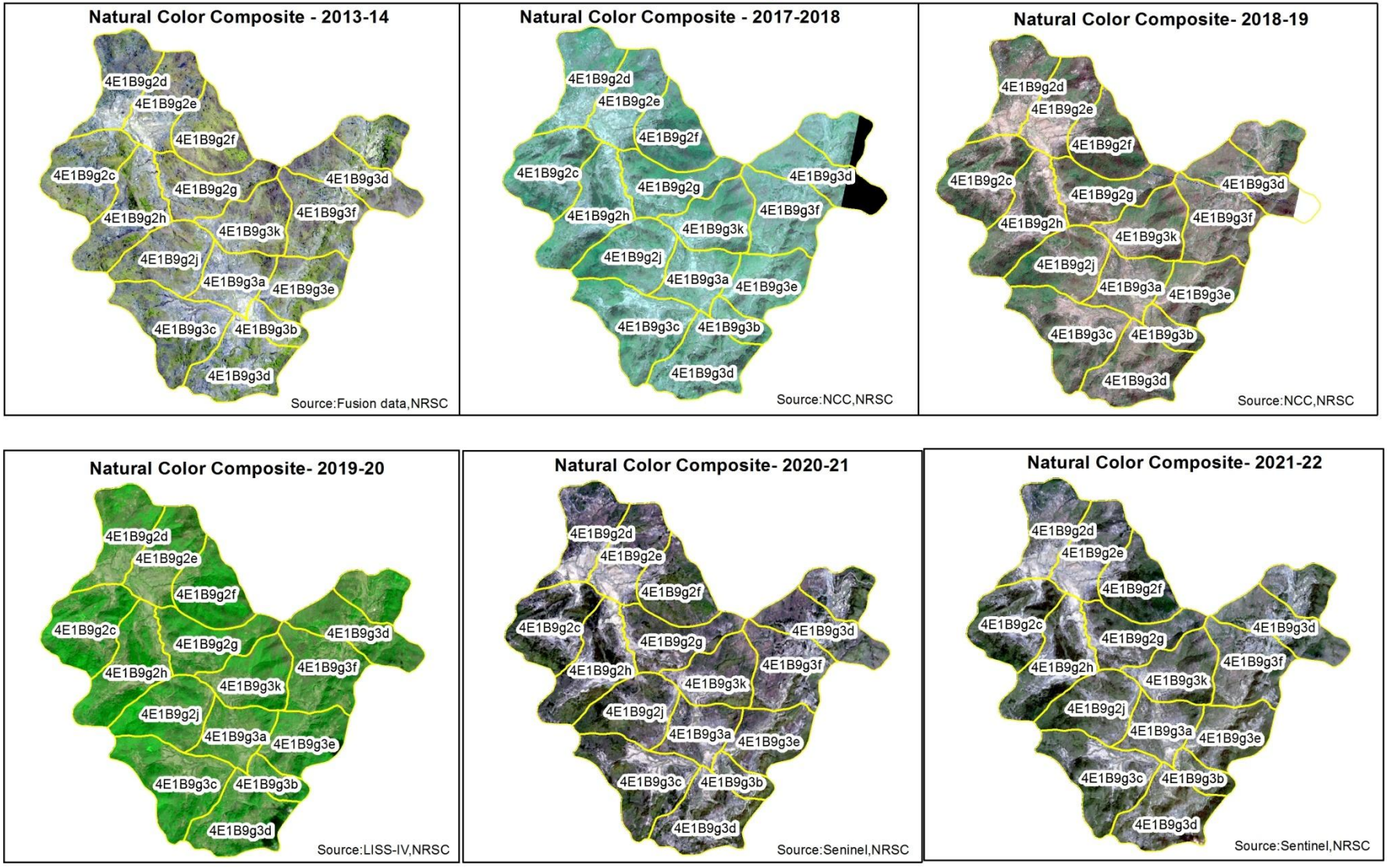


Fig 5. Monitoring of activities in Santhari Watershed (IWMP-01/2013-14) ,Visakhapatnam District, Andhra Pradesh

T0:2013-14

T1: 21 November 2017

Drishti Sl no. 1777786 MWS : 4E1B9g3d

Entry point activity

T0:2013-14

T1: 21 November 2017

Drishti Sl no. 1777843 MWS : 4E1B9g3c

Entry point activity

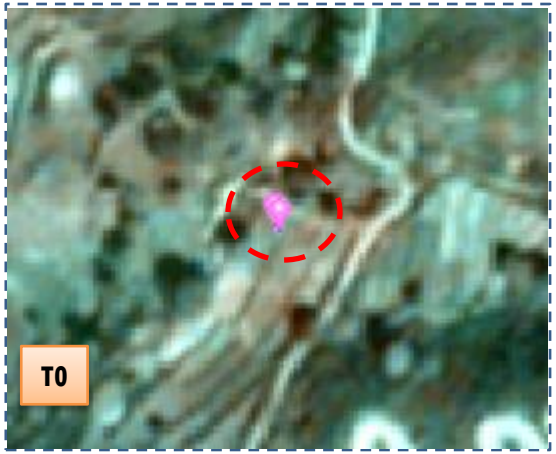
Fig 6. Monitoring of activities in Santhari Watershed (IWMP-01/2013-14) ,Visakhapatnam District, Andhra Pradesh

T0: 2013-14

T1: 21 November 2017

Drishti Sl no. 1789154 MWS : 4E1B9g3a

Entry point activity



T0: 2013-14

T1: 21 November 2017

Drishti Sl no. 1674100 MWS : 4E1B9g3e

Entry point activity

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. Santhari Watershed (IWMP-01/2013-14) -Comparative assessment of Land Use and Land Cover for Pre and Post IWMP implementation (2013-14 to 2017-18)

Scale: 1:10000

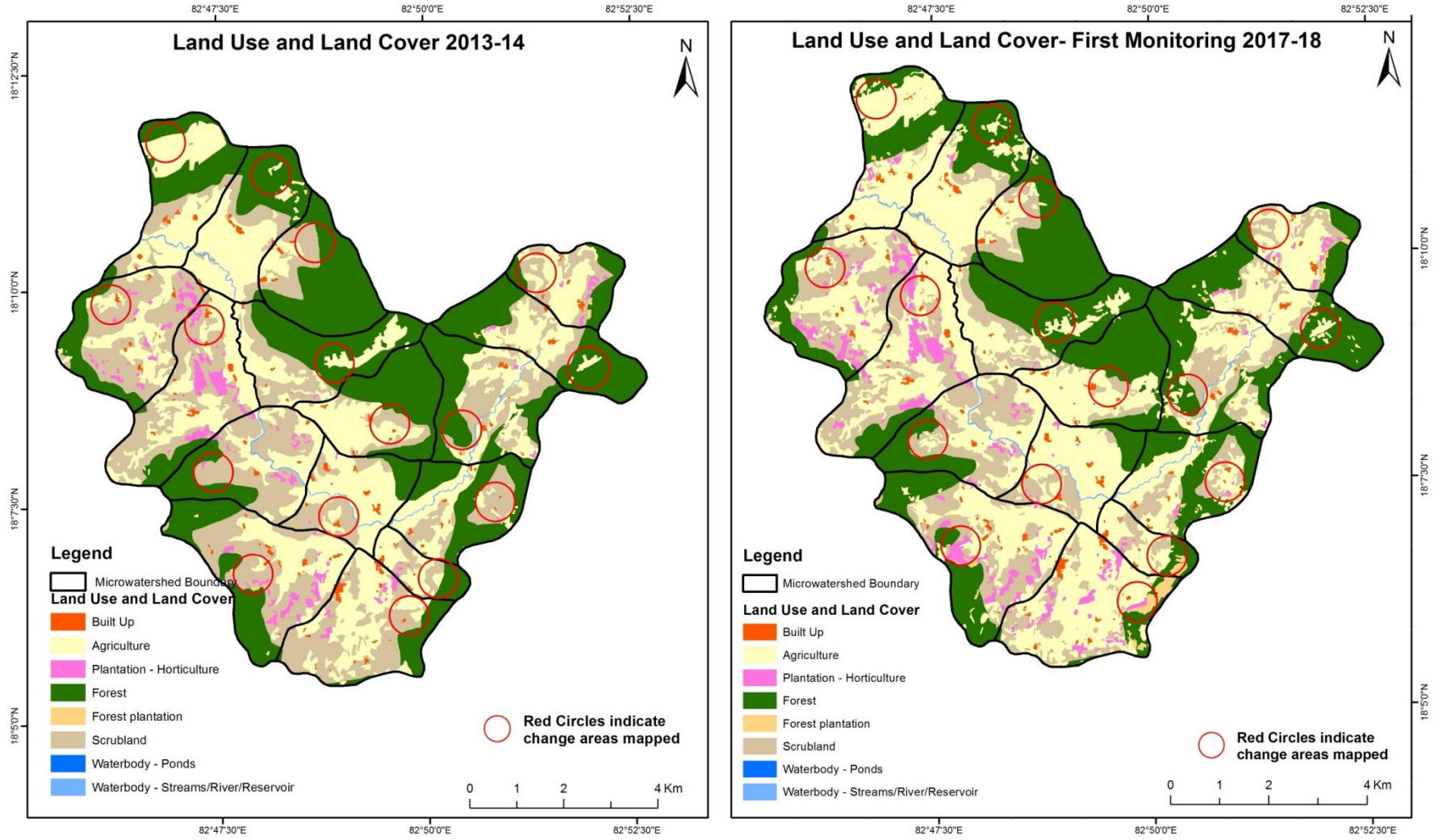


Fig 8. Santhari Watershed (IWMP-01/2013-14) -Comparative assessment of Land Use and Land Cover for Pre and Post IWMP implementation (2017-18 to 2018-19)

Scale: 1:10000

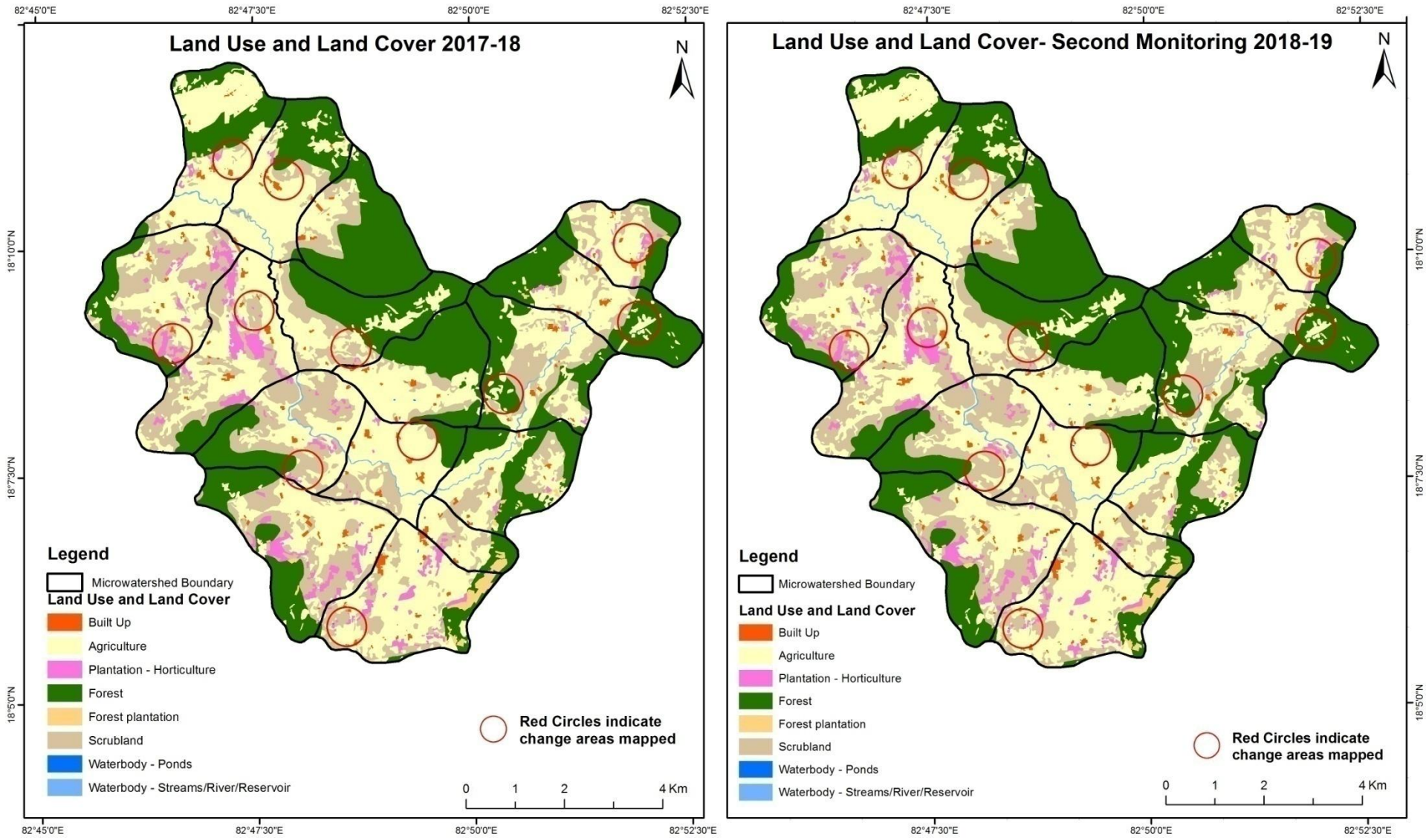
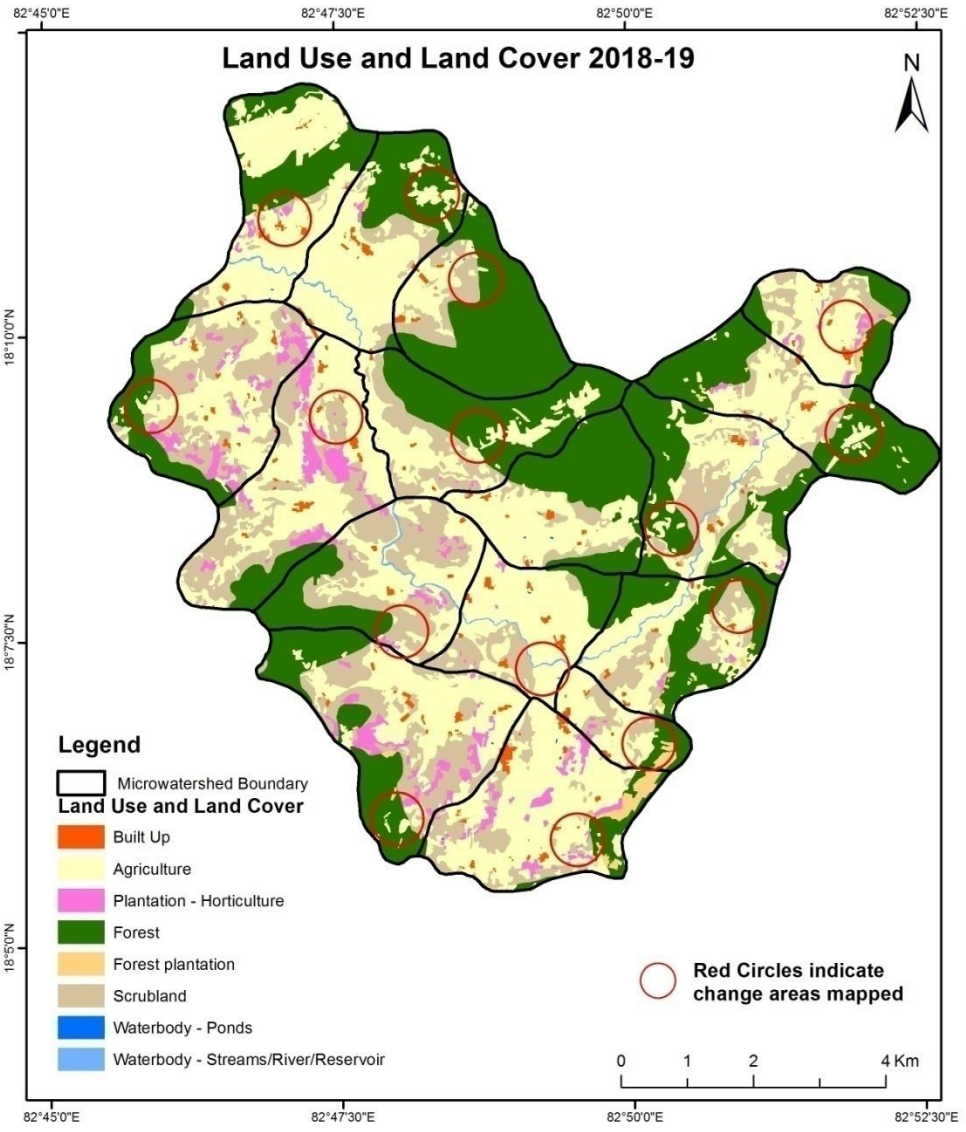


Fig 9. Santhari Watershed (IWMP-01/2013-14) -Comparative assessment of Land Use and Land Cover for Pre and Post IWMP implementation (2018-19 to 2019-20)

Scale: 1:10000



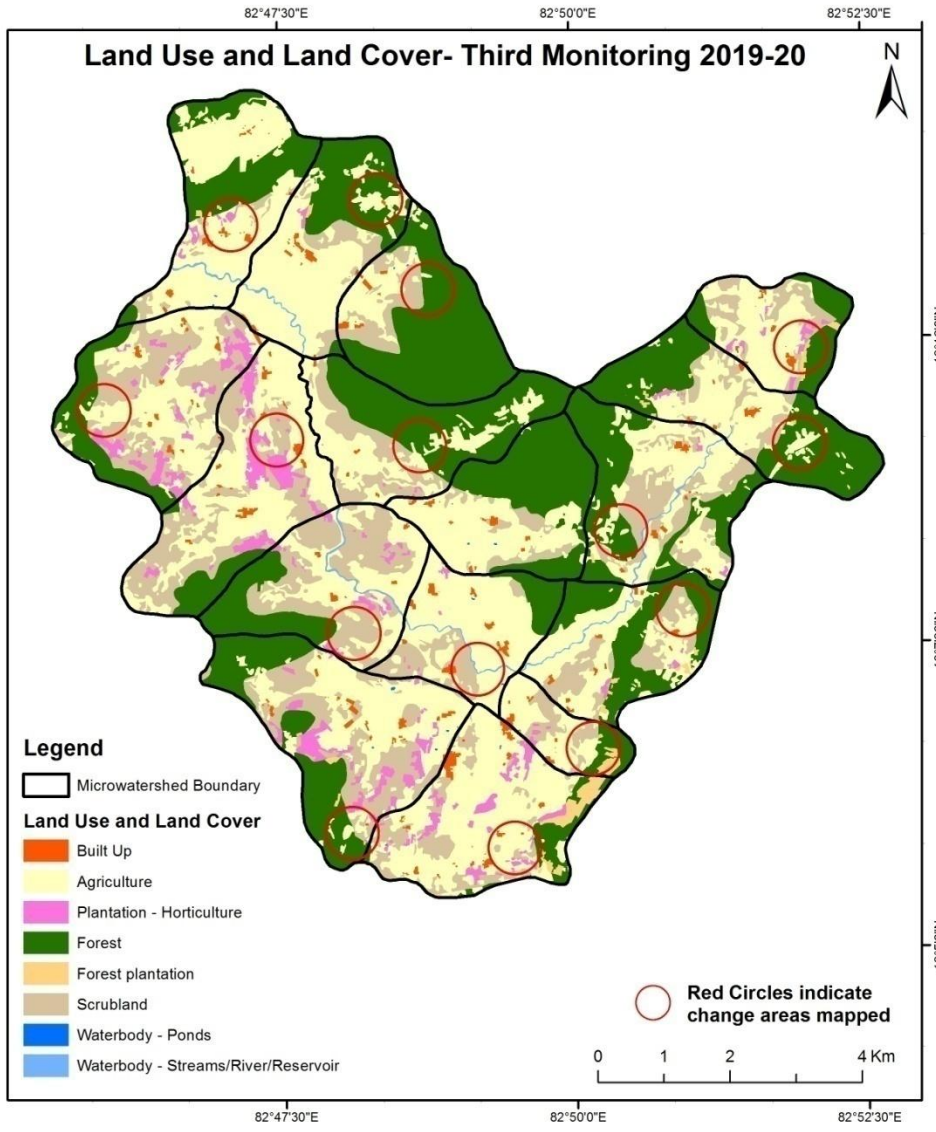
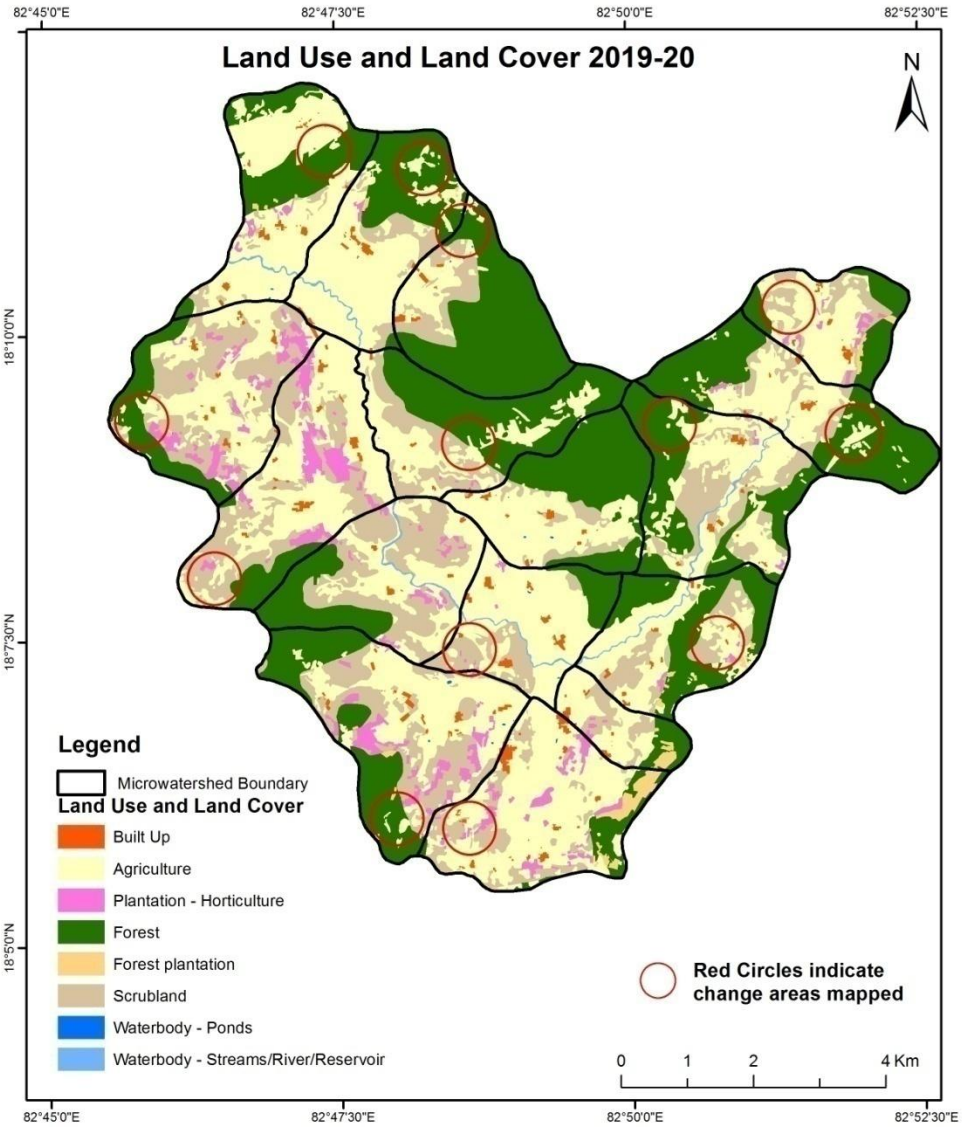


Fig 10. Santhari Watershed (IWMP-01/2013-14) -Comparative assessment of Land Use and Land Cover for Pre and Post IWMP implementation (2019-20 to 2020-21)

Scale: 1:10000



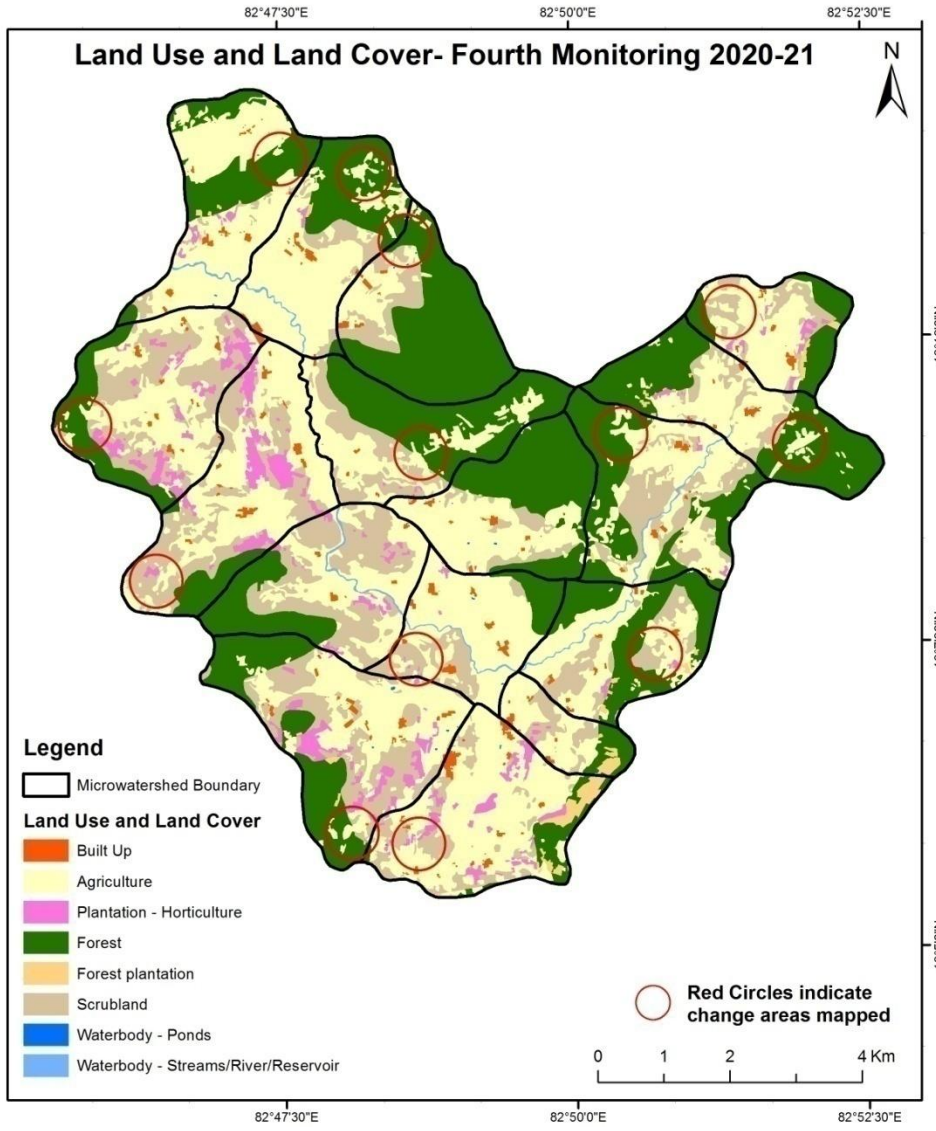
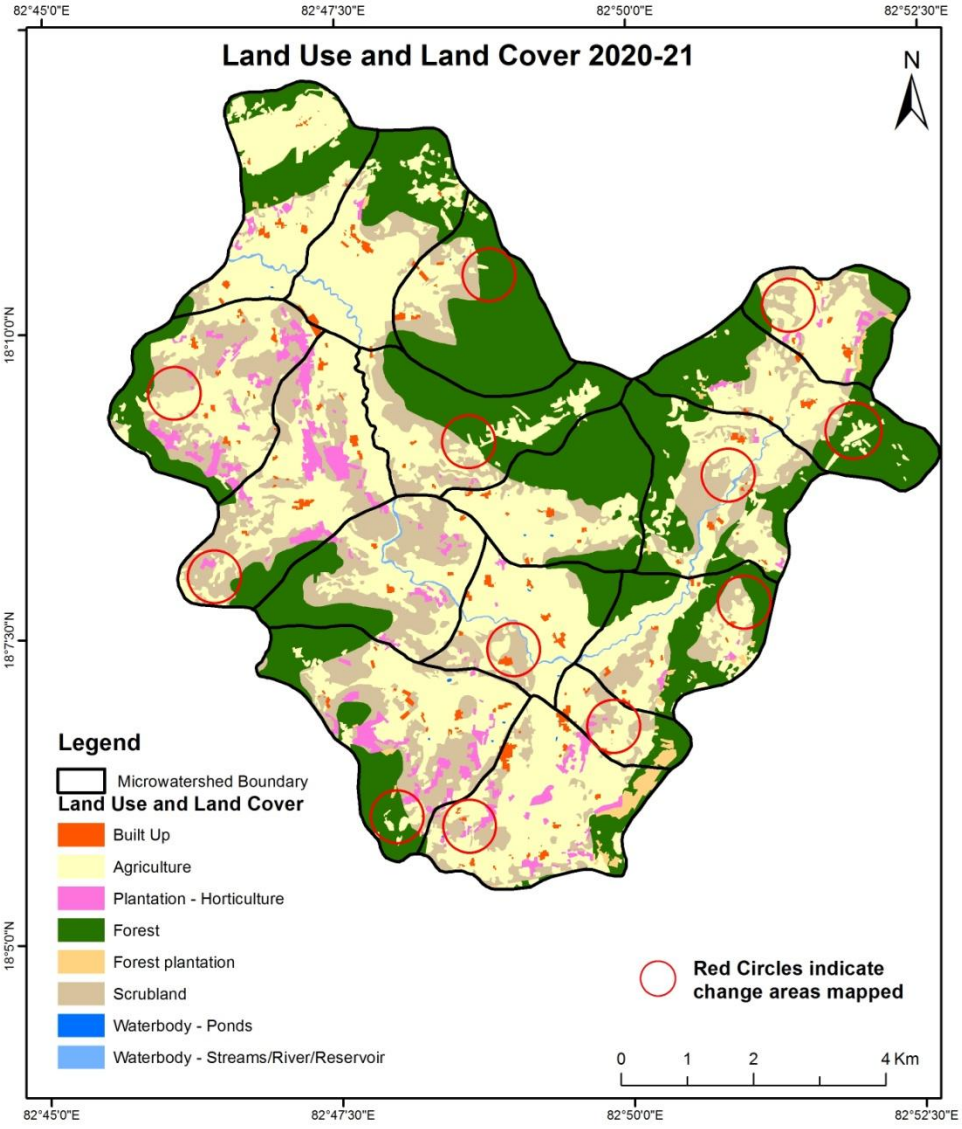


Fig 11. Santhari Watershed (IWMP-01/2013-14) -Comparative assessment of Land Use and Land Cover for Pre and Post IWMP implementation (2020-21 to 2021-22)

Scale: 1:10000



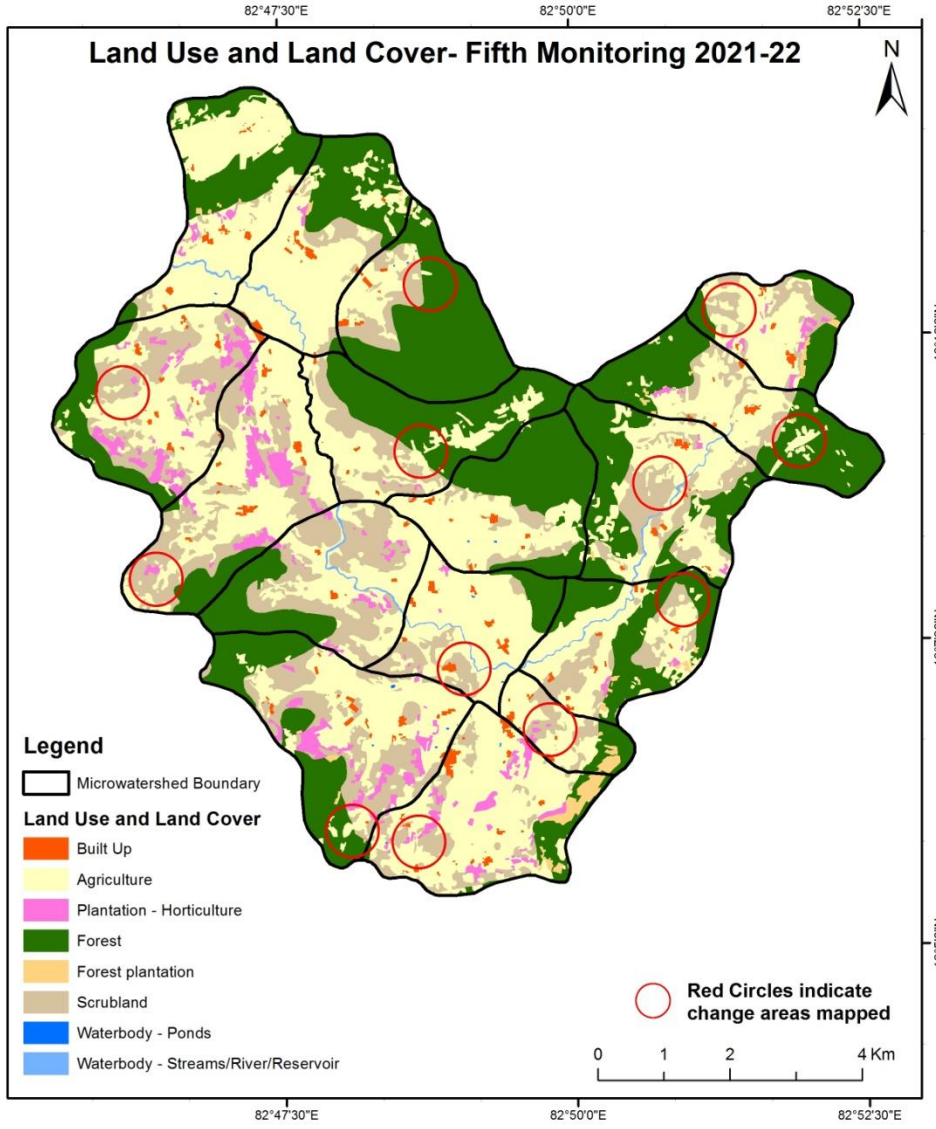
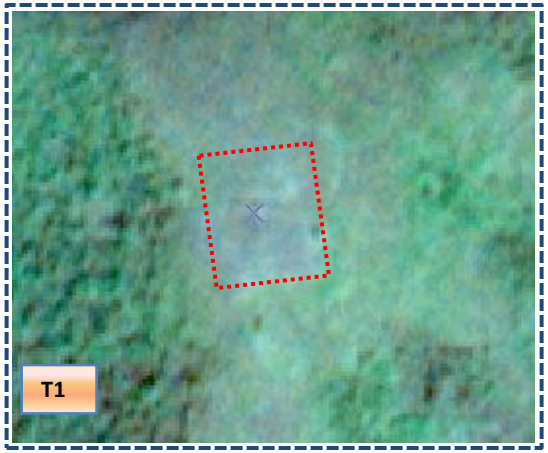


Fig 12. Santhari Watershed (IWMP-01/2013-14) -Land Use and Land Cover changes for Pre and Post treatment dates

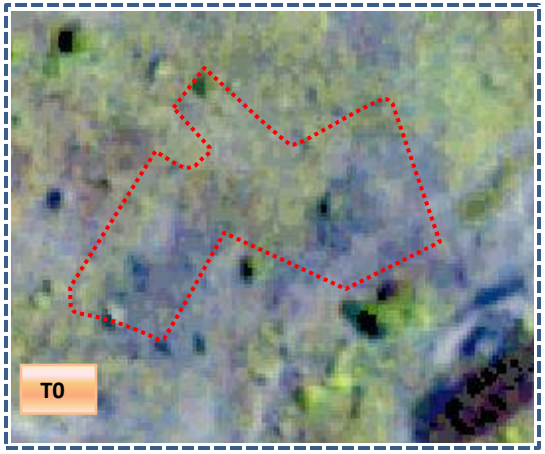
Scrub to Agriculture

T0: 2013-14 (82°47'2.898"E 18°9'38.333“N)

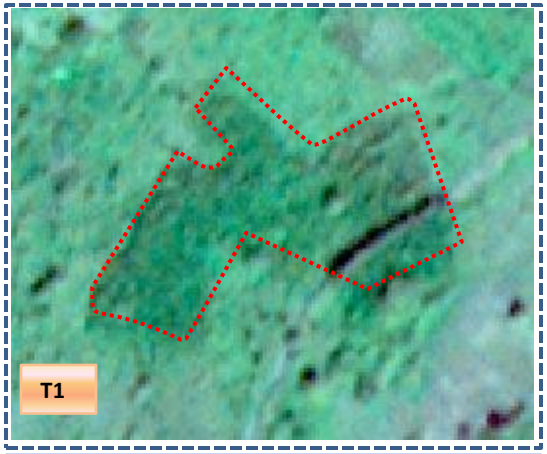


T1: 21 November 2017

Scrub to Plantation



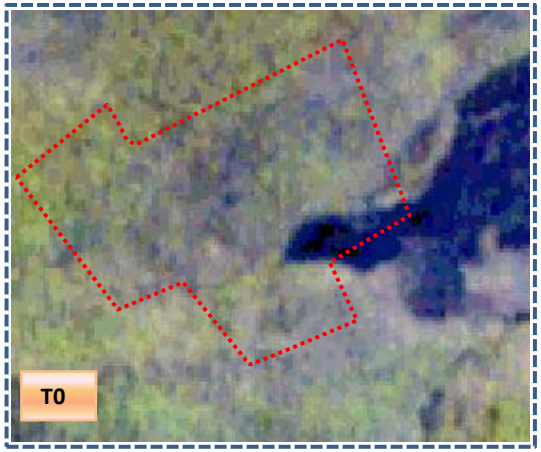
T0: 2013-14 (82°46'22.161"E 18°8'7.264"N)



T1: 21 November 2017

Fig 13. Santhari Watershed (IWMP-01/2013-14) -Land Use and Land Cover changes for Pre and Post treatment dates

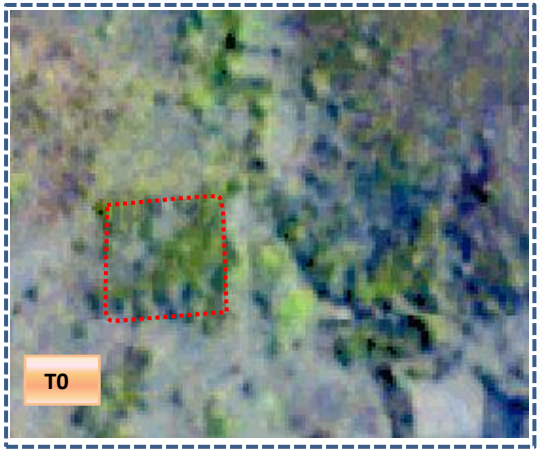
Forest to Agriculture



T0: 2013-14 (82°48'7.529"E 18°11'22.791"N)

T1: 21 November 2017

Forest to Forest Plantation



T0: 2013-14 (82°46'49.379"E 18°11'3.213"N)

T1: 21 November 2017

Table 4. showing change matrix depicting Land cover transitions for Santhari Watershed (IWMP-01/2013-14) 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	93.57										**93.57**
Mining/dump											
Agriculture	6.05		2590.53	5.03	27.69	3.15				0.98	**2633.43**
Plantation Horticulture			2.13	164.33	1.02						**167.48**
Forest	0.08		156.99		2533.17	51.74				0.03	**2742.01**
Forest Plantation						5.16					**5.16**
Barren Rocky											
Scrub	3.94		628.01	100.22				1634.68		0.26	**2367.11**
Waterbody-Streams/River									40.86		**40.86**
Waterbody – Ponds											
Grand Total	**103.64**		**3377.66**	**269.58**	**2561.88**	**60.05**		**1634.68**	**40.86**	**1.27**	**8049.62**

Interpretation: The example of "Agriculture" Land cover for the period 2013-14 to 2017-18

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 39.7 ha of the agriculture area has decreased and it is converted into Built-up, plantation/horticulture (5 ha), forest (27 ha), forest plantation (3.1 ha) and water body (0.9 ha) in T1.

3. In T1 787 ha of the agriculture area has increased from plantations/horticulture (2 ha), forest (157 ha) and scrubland (628 ha) of T0.

Table 5. showing change matrix depicting Land cover transitions for Santhari Watershed (IWMP-01/2013-14) 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	103.64										**103.64**
Mining/dump											
Agriculture	0.99		3374.72		1.79					0.16	**3377.66**
Plantation Horticulture			0.68	268.9							**269.58**
Forest			3.14		2558.74						**2561.88**
Forest Plantation						60.05					**60.05**
Barren Rocky											
Scrub	0.5		39					1595.18			**1634.68**
Waterbody-Streams/River									40.86		**40.86**
Waterbody – Ponds										1.27	**1.27**
Grand Total	**105.13**		**3417.54**	**268.9**	**2560.53**	**60.05**		**1595.18**	**40.86**	**1.43**	**8049.62**

4. In T1 2.9 ha of the agriculture area has decreased and it is converted into Built-up (0.9 ha), forest (1.7 ha) and water body (0.16 ha) in T2.

5. In T2 42 ha of the agriculture area has increased from plantations (0.6 ha), forest (3.1 ha) and scrubland (39 ha) of T1.

Table showing change matrix depicting Land cover transitions for Santhari Watershed (IWMP-01/2013-14) 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	105.13										**105.13**
Mining/dump											
Agriculture	0.1		3415.21					1.76		0.47	**3417.54**
Plantation Horticulture				268.9							**268.9**
Forest			6.56		2553.97						**2560.53**
Forest Plantation						60.05					**60.05**
Barren Rocky											
Scrub	1.12		9.3					1584.76			**1595.18**
Waterbody-Streams/River									40.86		**40.86**
Waterbody – Ponds										1.43	**1.43**
Grand Total	**106.35**		**3431.07**	**268.9**	**2553.97**	**60.05**		**1586.52**	**40.86**	**1.9**	**8049.62**

6. In T2 2.3 ha of the agriculture area has decreased and it is converted into Built-up (0.1 ha), scrub (1.7 ha) and water body (0.47 ha) in T3.

7. In T3 15.8 ha of the agriculture area has increased from forest (6.5 ha) and scrubland (9.3 ha) of T2.

Table showing change matrix depicting Land cover transitions for Santhari Watershed (IWMP-01/2013-14) 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	106.35										**106.35**
Mining/dump											
Agriculture	2.17		3428.9								**3431.07**
Plantation Horticulture			0.26	268.64							**268.9**
Forest			7.98		2545.99						**2553.97**
Forest Plantation						60.05					**60.05**
Barren Rocky											
Scrub			45.32					1541.2			**1586.52**
Waterbody-Streams/River									40.86		**40.86**
Waterbody – Ponds										1.9	**1.9**
Grand Total	**108.52**		**3482.46**	**268.64**	**2545.99**	**60.05**		**1541.2**	**40.86**	**1.9**	**8049.62**

7. In T3 2.17 ha of the agriculture area has decreased and it is converted into built-up (2.17 ha) in T4.

8. In T4 53.5 ha of the agriculture area has increased from plantations (0.26 ha), forest (7.9 ha) and scrubland (45.3 ha) of T3.

Table showing change matrix depicting Land cover transitions for Santhari Watershed (IWMP-01/2013-14) 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	108.52										**108.52**
Mining/dump											
Agriculture	0.24		3481.45					0.77			**3482.46**
Plantation Horticulture				268.64							**268.64**
Forest			1.16		2544.83						**2545.99**
Forest Plantation						60.05					**60.05**
Barren Rocky											
Scrub			32.12					1509.08			**1541.2**
Waterbody-Streams/River									40.86		**40.86**
Waterbody – Ponds										1.9	**1.9**
Grand Total	**108.76**		**3514.73**	**268.64**	**2544.83**	**60.05**		**1509.85**	**40.86**	**1.9**	**8049.62**

9. In T4 1.1 ha of the agriculture area has decreased and it is converted into built-up (0.24 ha) and scrubland (0.77 ha) in T5.

10. In T5 80 ha of the agriculture area has increased from forest (1.16 ha) and scrubland (32.12 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 increase of 1.9 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 744, 39, 13, 51 & 32 Hectares from T0-T1, T1-T2, T2-T3, T3-T4 & T4-T5 respectively and overall increase of 881 Hectares in Crop land area as compared between baseline Land Use/Land Cover data 2013-14 (T0) & 2021-22 (T5) years.
4. About **101 ha of the plantation/horticulture area has been increased** in during the monitoring period of 2013-14 (T0) to 2021-22 (T5) years.
5. There is a decrease of 857 Hectares in Scrubland area as compared between 2013-14 (T0) & 2021-22 (T5) years.
6. Farm ponds (09) is visible on IWMP (Integrated Watershed Management Programme) Bhuvan Srishti portal out of Bhuvan Drishti photo of Farm ponds (09) 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