MONITORING OF IWMP WATERSHED PROJECTS USING GEO-INFORMATION

SUMMARY REPORT

SRIKAKULAM -20/2013-14
Andhra Pradesh

Submitted to NRSC, Balanagar, Hyderabad
February-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,
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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-20/2013-14, Srikakulam District of Andhra Pradesh. The total geographical area of the project is **6,849 ha**. It comprises of 23 micro watersheds.
4. In the project area 239 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 52.8 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. 49.4 % is covered by the agriculture, 24.4 % is covered by forest, 8.3 % is covered by plantation/horticulture, 4.4 % is covered by scrubland and remaining by other land use classes.

STUDY AREA
PROJECT : NALLARAIGUDA (IWMP-20/2013-14)
DISTRICT : SRIKAKULAM , STATE : ANDHRA PRADESH

- The study area falls in Bhamini Mandal of Srikakulam district of Andhra Pradesh state. The total geographical area of the project is **6,849 ha**. It comprises of 23 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 & Table 2.

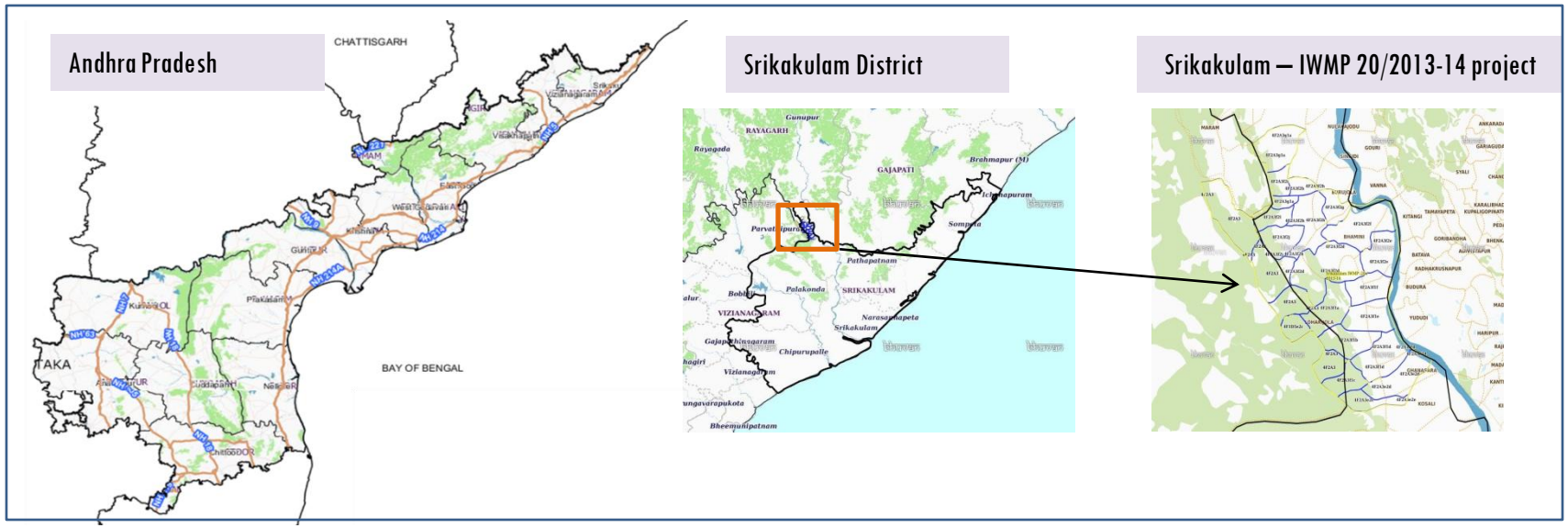


Fig.1. Location map of Nallaraiguda Watershed (IWMP-20/2013-14) in Srikakulam District, A.P

- The Climate of the district is moderate and characterized by high humidity all through the year along with oppressive summer and good seasonal rainfall.
- The mean daily maximum temperature in the district is about 34 C in May and the mean daily minimum temperature is about 17.5 C in December/ January.
- The average annual rainfall of the district is 1067 mm, which ranges from nil rainfall in January and November 208 mm in September and October. The mean seasonal rainfall distribution is 745 mm in southwest monsoon (June- September).

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-Feb-22
SCENE2			
SCENE 3			
SCENE 4			
CARTO	2013-14		
SCENE 1			21-Feb-22
SCENE2			
SCENE 3			
SCENE 4			

Linear Image Self Scanner (LISS)

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	239
4	Detailed Project Report		

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

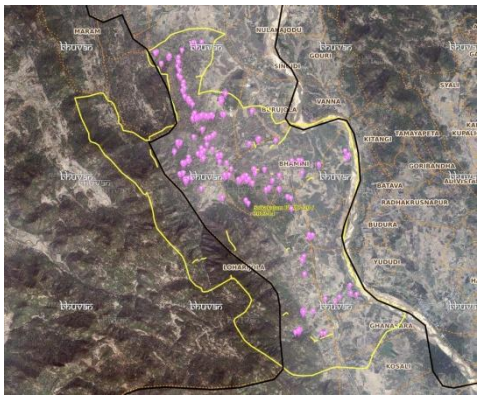
Legend

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	9	9
4	Pasture	0	0
5	Trench	0	0
6	Field Bunds	0	0
7	Terrace	0	0
8	Checks & Plugs	1	1
9	Gabion structure	0	0
10	Farm ponds/Dug out pit	2	2
11	Civil work-Check dams/Rock fill dam	44	44
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	15	15
18	Others	174	168
	TOTAL	**245**	**239**

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. Nallaraiguda Watershed (IWMP-20/2013-14) Natural Colour Composite-2013-14 to 2021-22

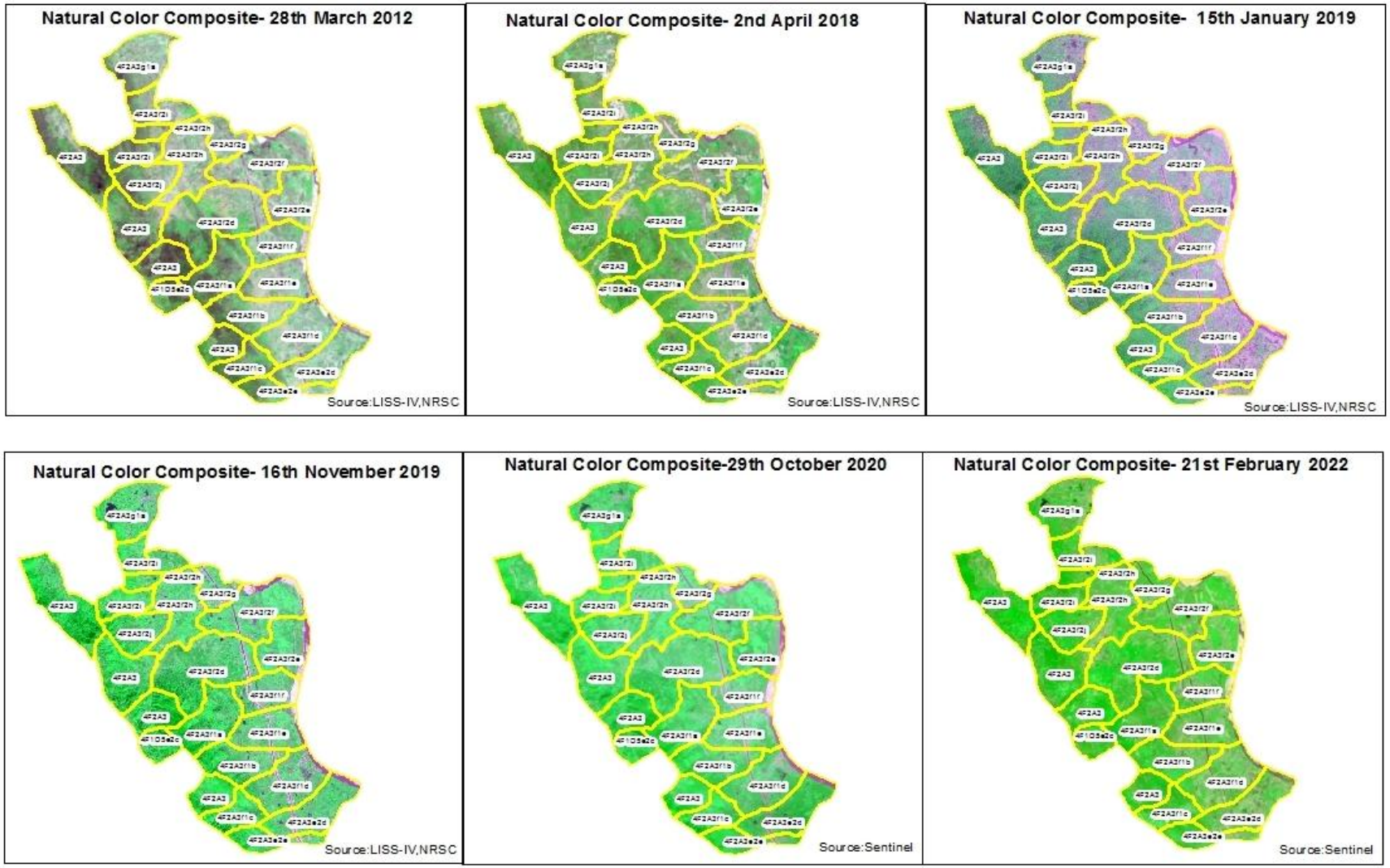


Fig 5. Nallaraiguda Watershed (IWMP-20/2013-14) Monitoring of activities in Srikakulam District, Andhra Pradesh

T0:2013-14

T1: 16 January 2017

Drishti Sl no. 1815109 MWS : 4F2A3f2d

Farm pond

T0:2013-14

T1: 16 January 2017

Drishti Sl no. 2213654 MWS : 4F2A3f2j

Farm pond

Fig 6. Nallaraiguda Watershed (IWMP-20/2013-14) Monitoring of activities in Srikakulam District, Andhra Pradesh

T0:2013-14

T1: 16 January 2017

Drishti Sl no. 2213869 MWS : 4F2A3f2h

Farm pond

T0:2013-14

T1: 16 January 2017

Drishti Sl no. 7018632 MWS : 4F2A3f2h

Percolation tank

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. Nallaraiguda Watershed (IWMP-20/2013-14) Comparative assessment of Land Use and Land Cover for Pre and Post IWMP implementation (2013-14 to 2017-18)

Scale: 1:10000

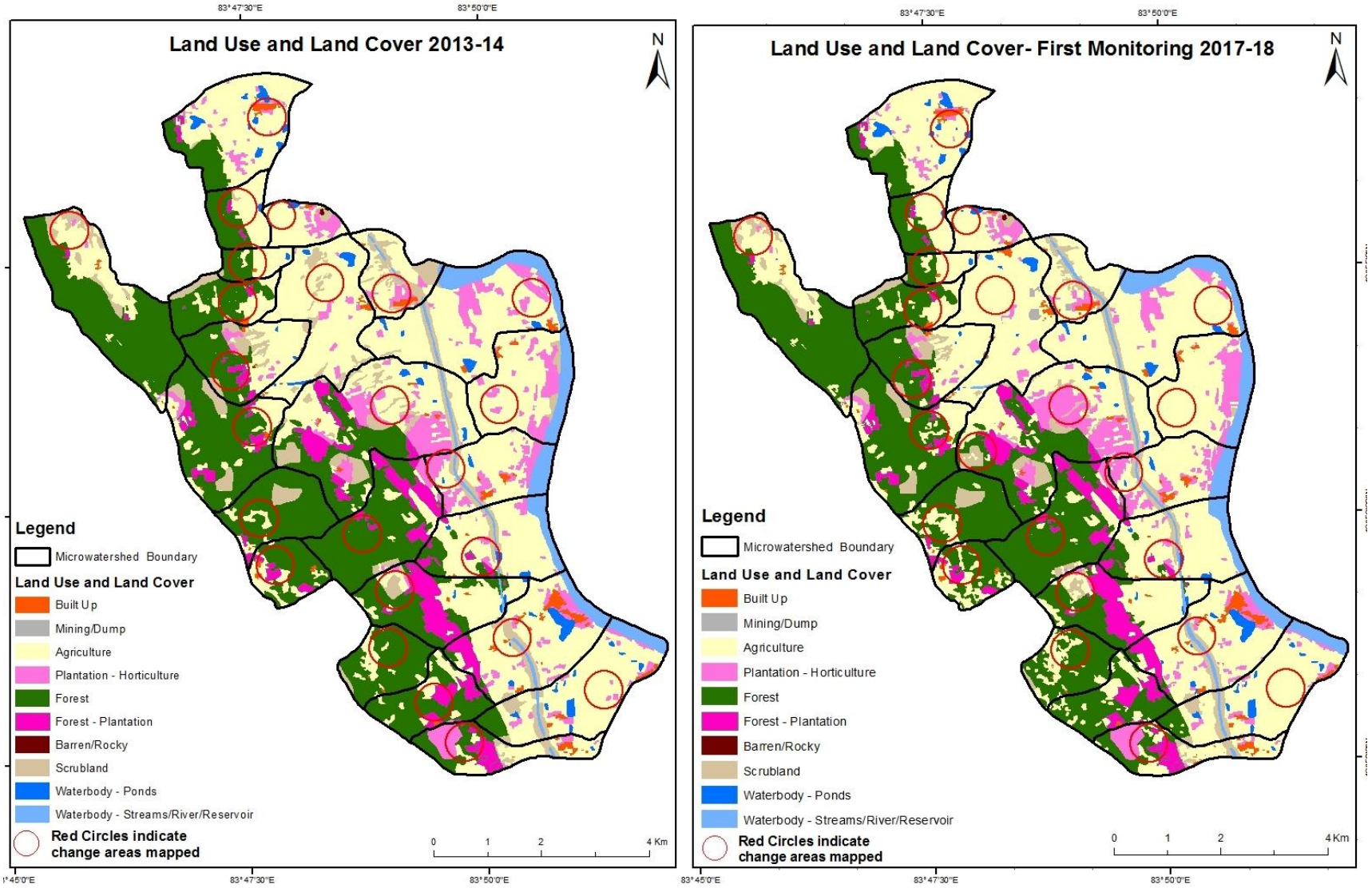
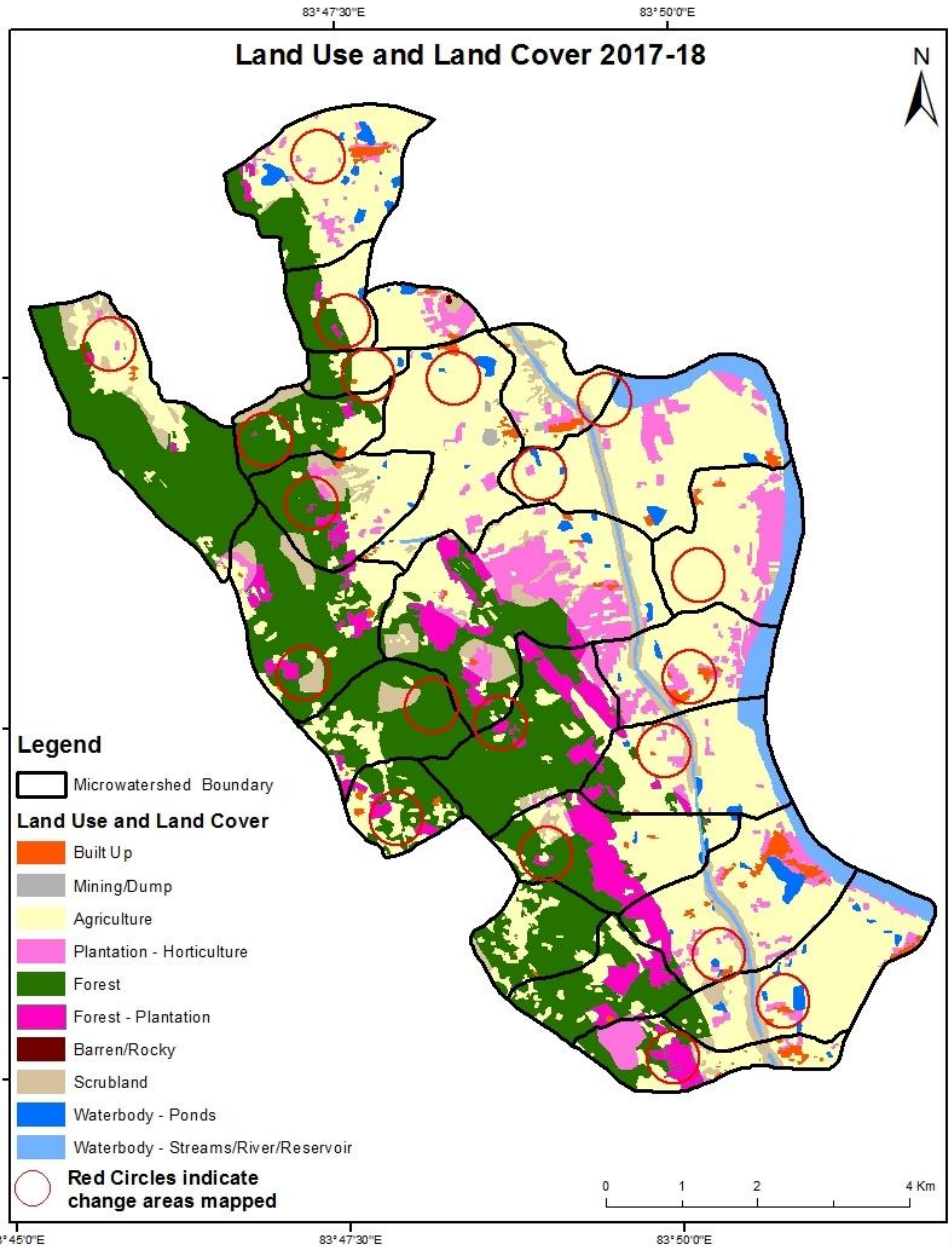


Fig 7. Nallaraiguda Watershed (IWMP-20/2013-14) Comparative assessment of Land Use and Land Cover for Pre and Post IWMP implementation (2017-18 to 2018-19)

Scale: 1:10000



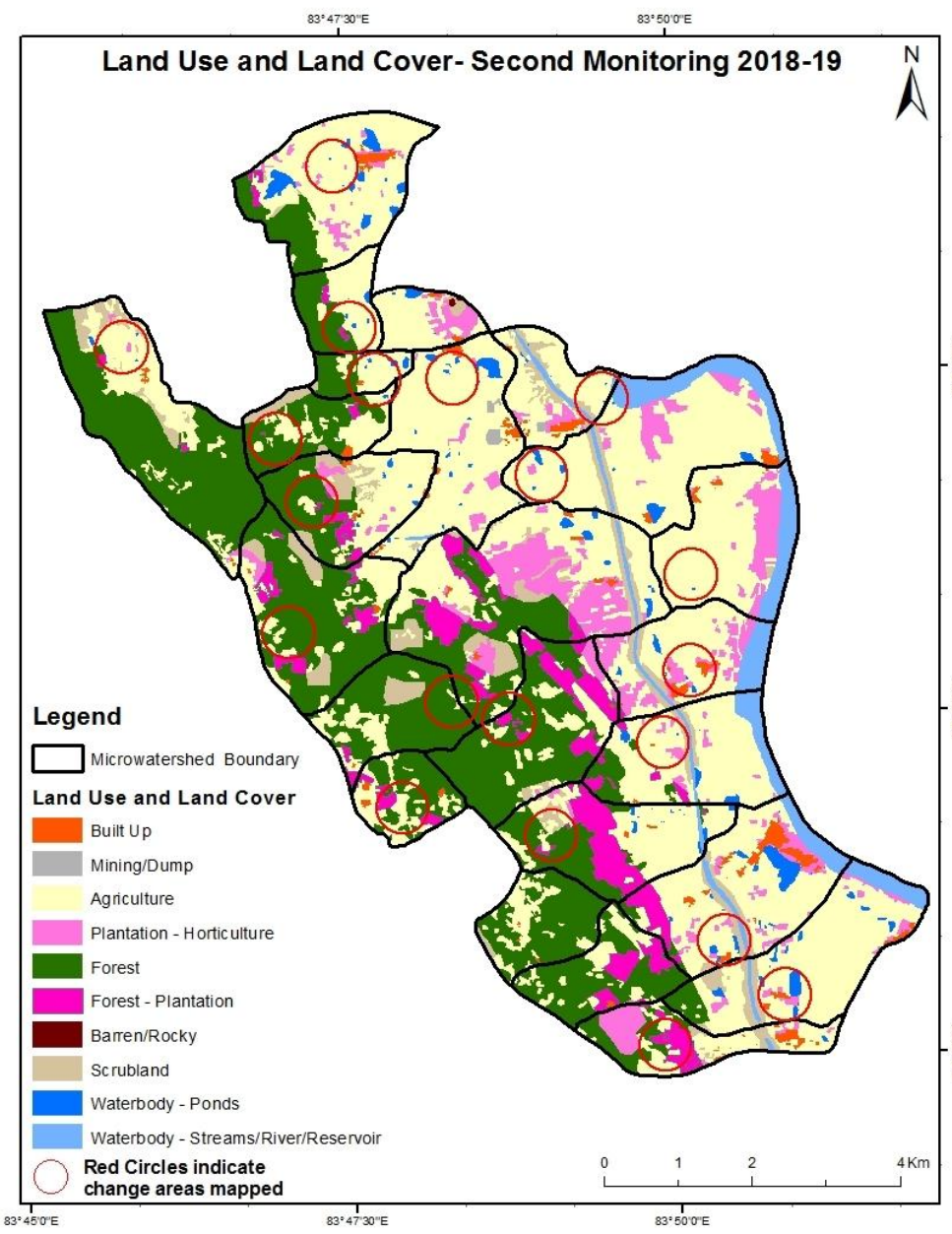
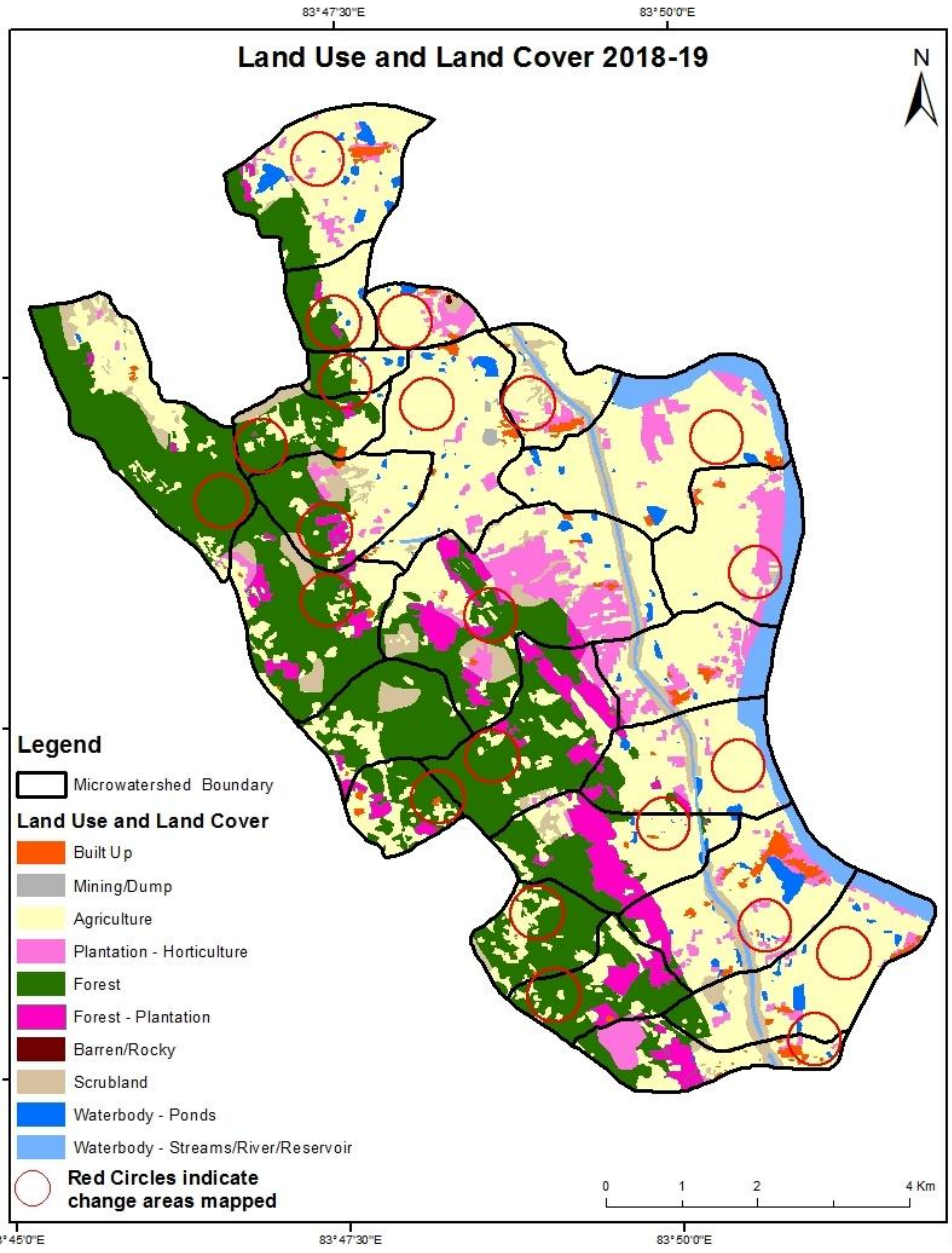


Fig 7. Nallaraiguda Watershed (IWMP-20/2013-14) Comparative assessment of Land Use and Land Cover for Pre and Post IWMP implementation (2018-19 to 2019-20)

Scale: 1:10000



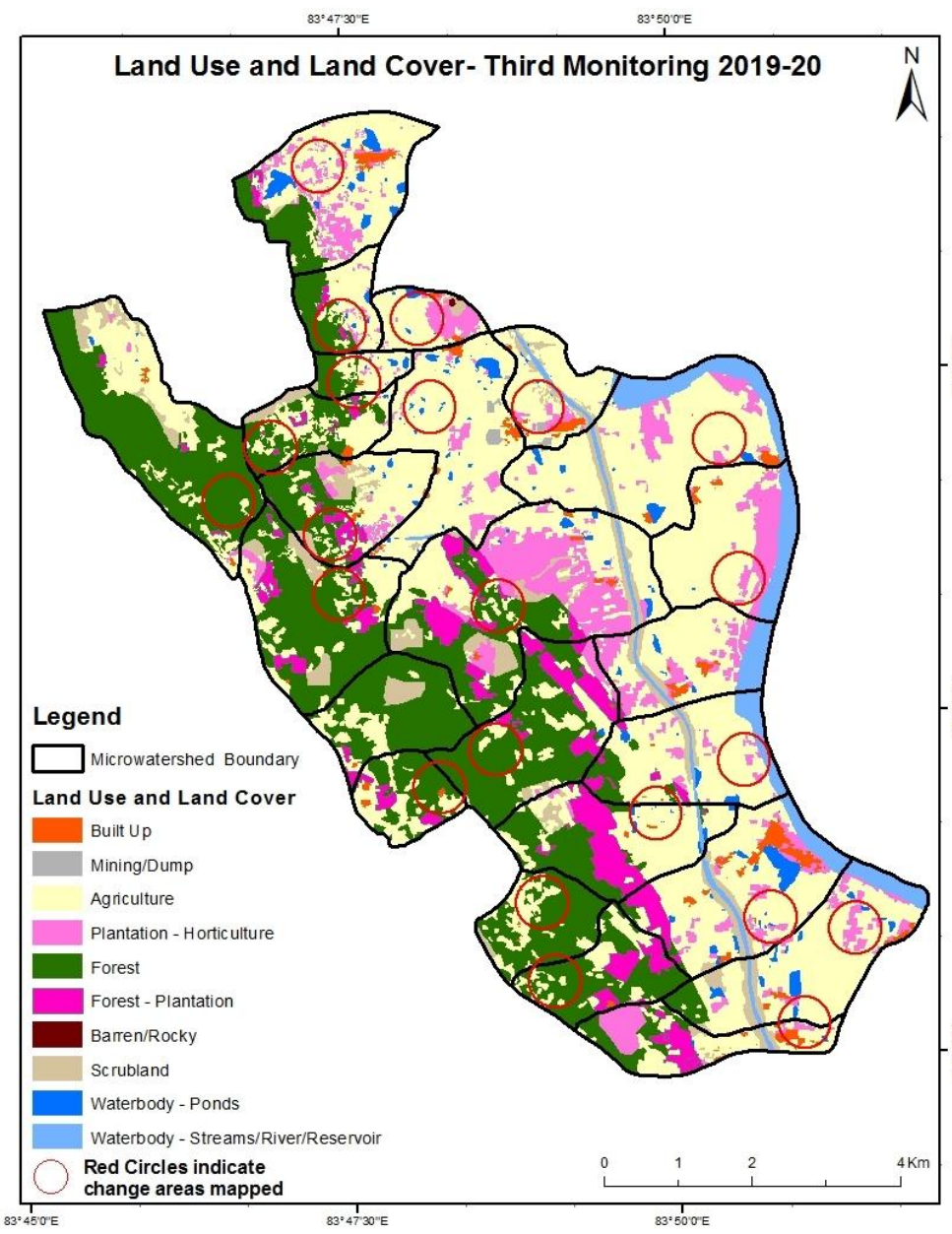
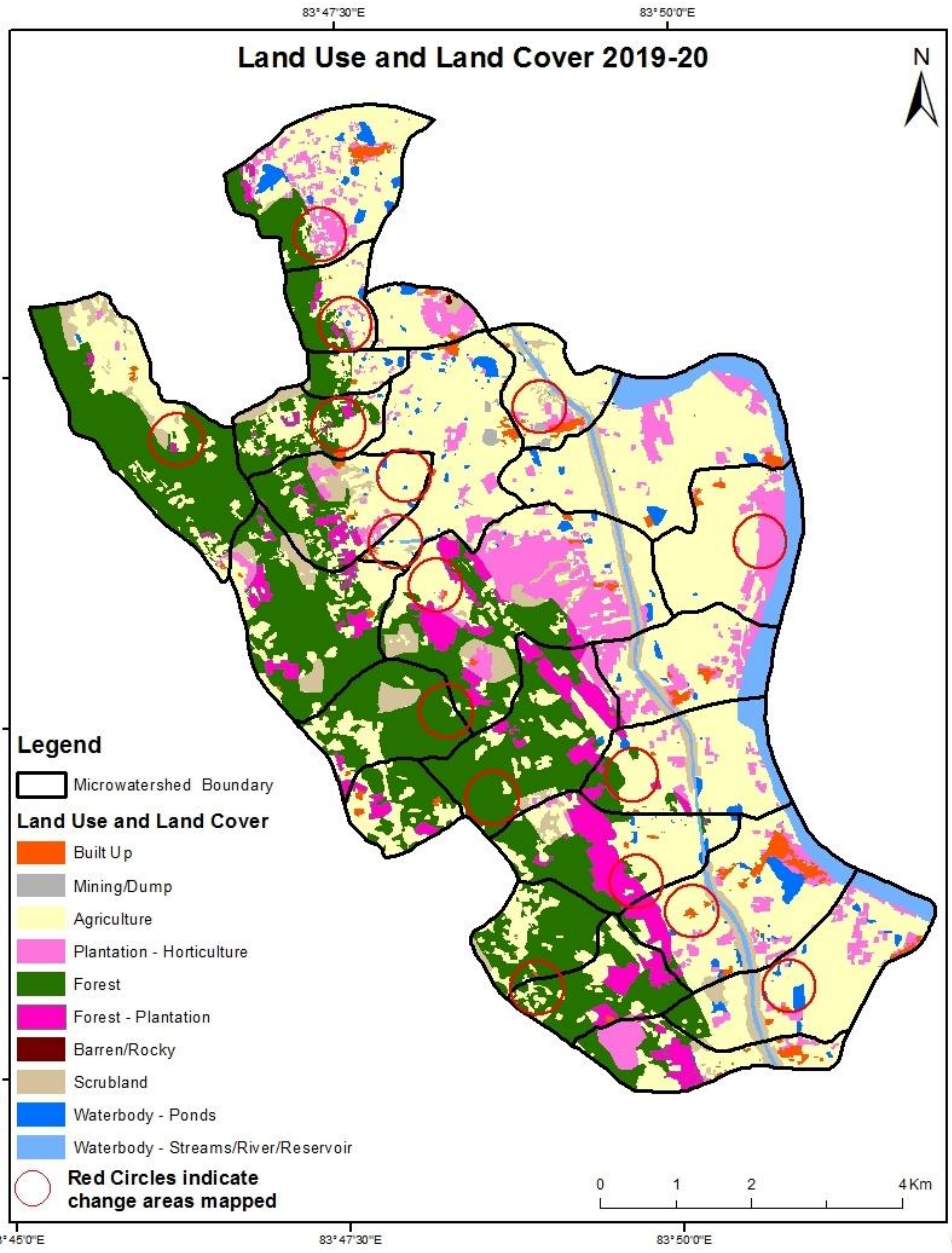


Fig 7. Nallaraiguda Watershed (IWMP-20/2013-14) Comparative assessment of Land Use and Land Cover for Pre and Post IWMP implementation (2019-20 to 2020-21)

Scale: 1:10000



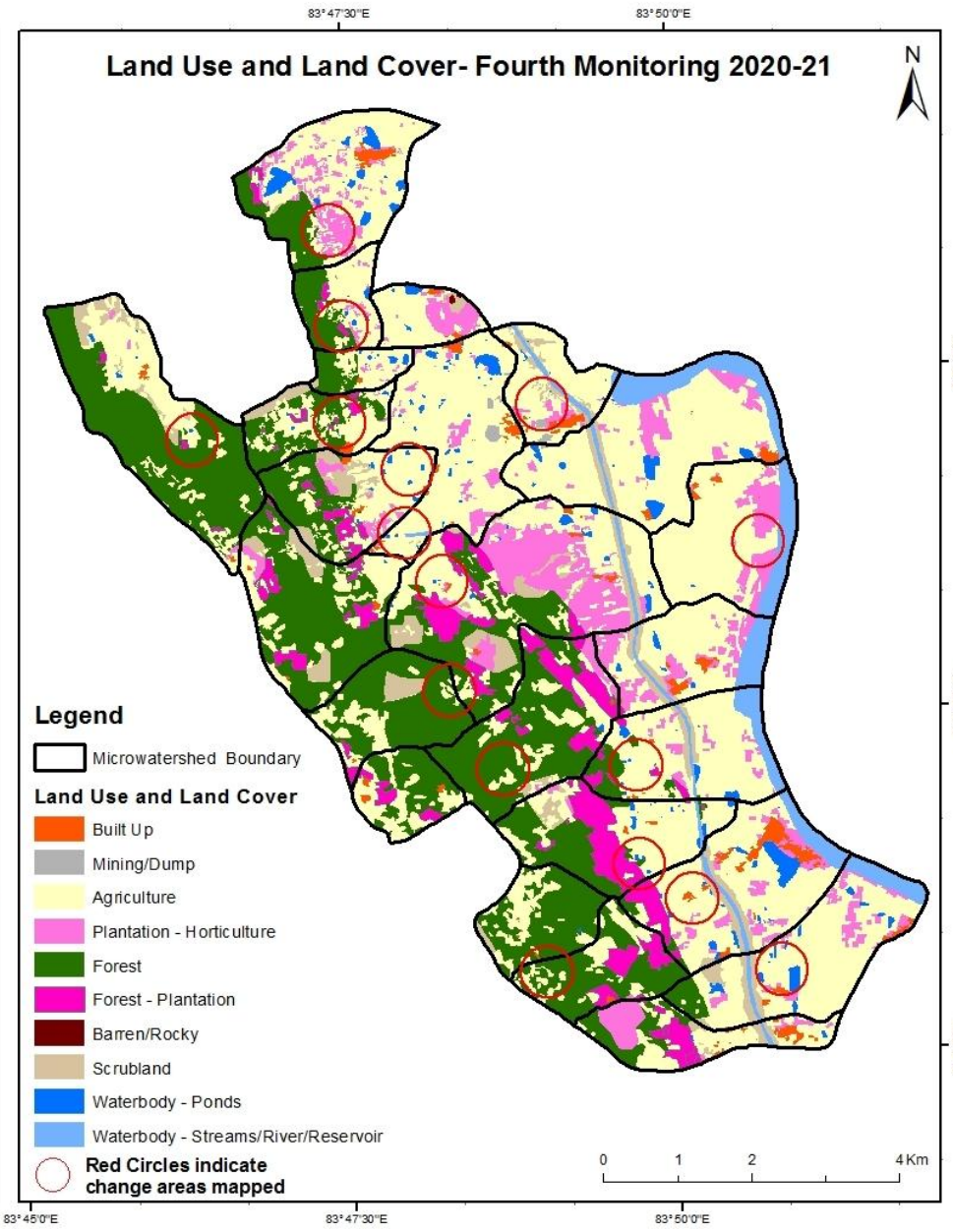
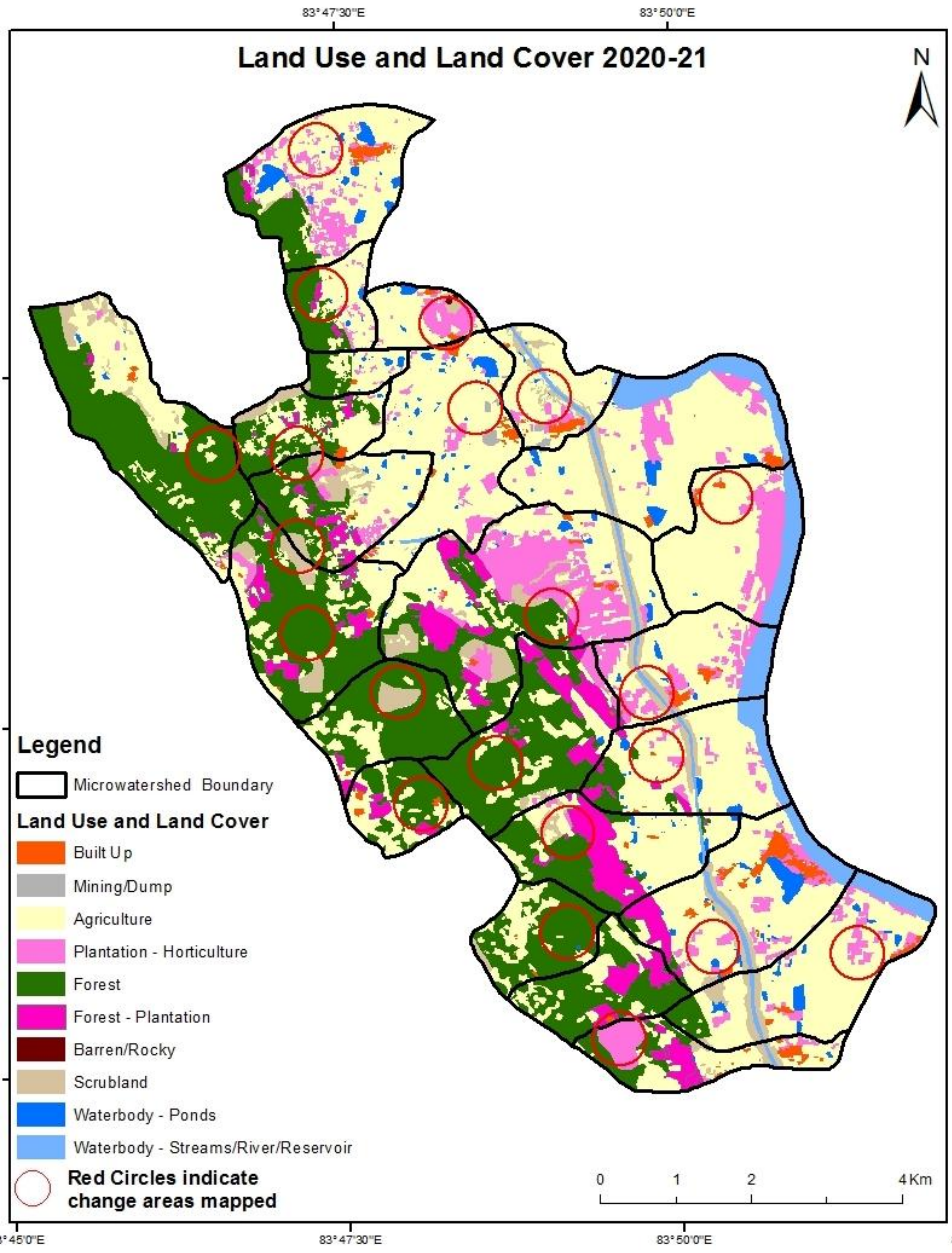


Fig 7. Nallaraiguda Watershed (IWMP-20/2013-14) Comparative assessment of Land Use and Land Cover for Pre and Post IWMP implementation (2020-21 to 2021-22)

Scale: 1:10000



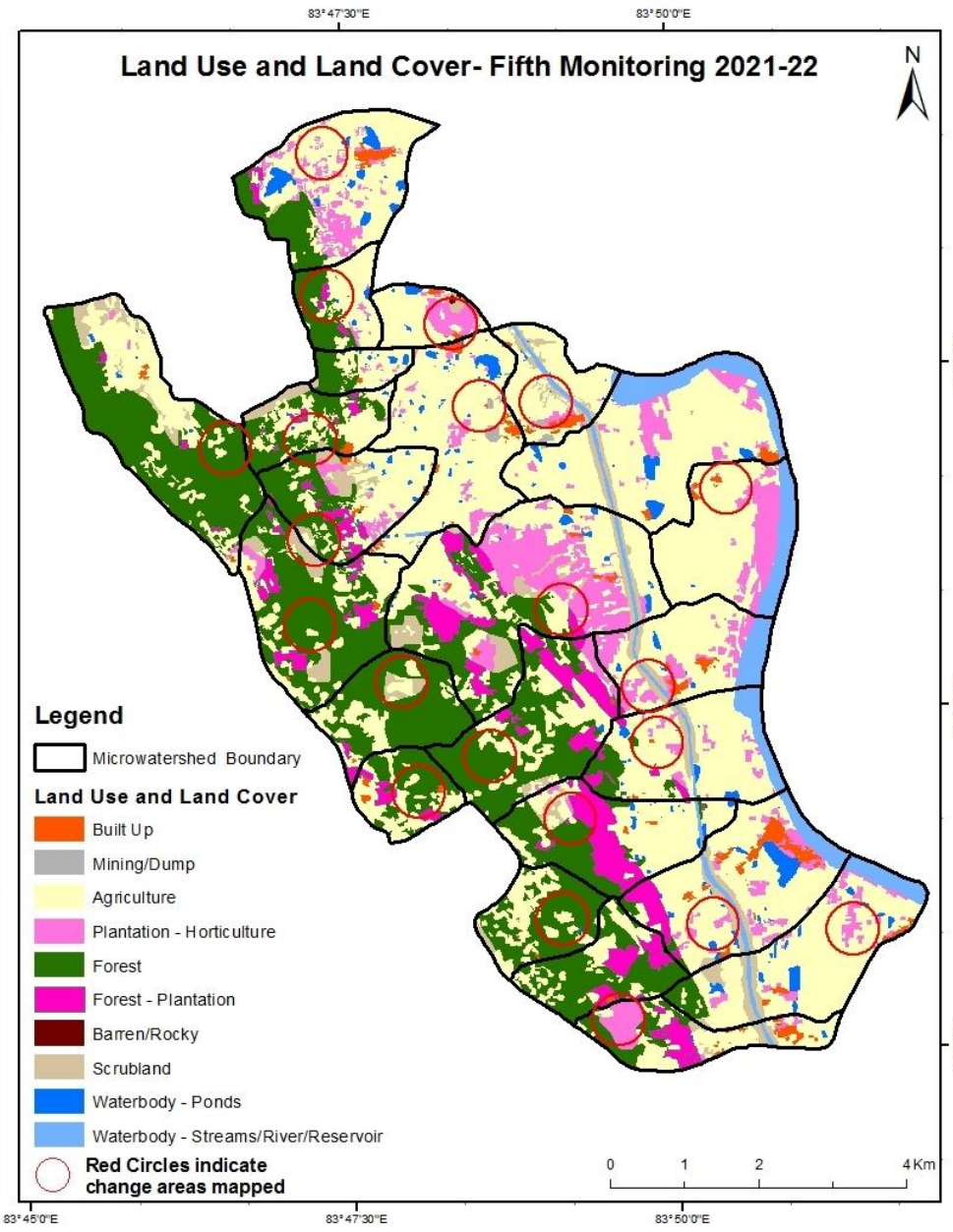
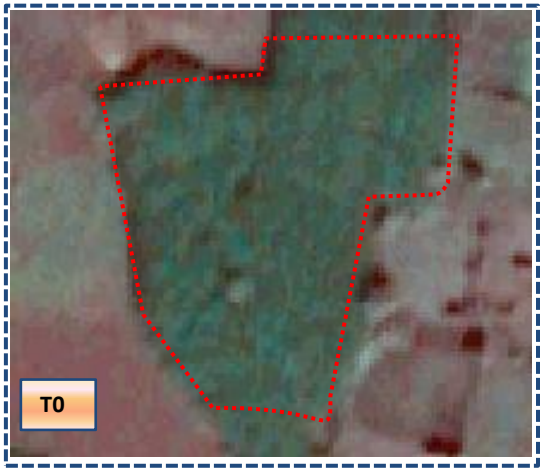
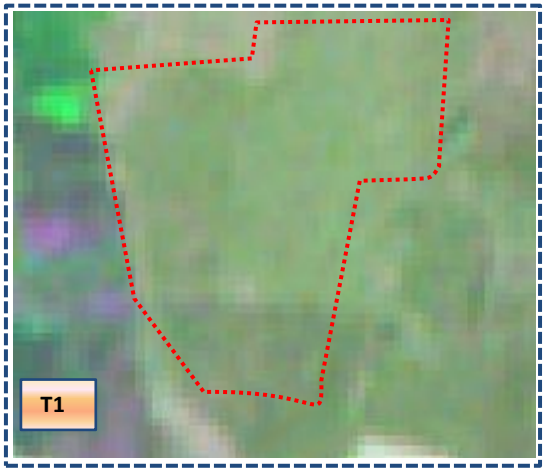


Fig 6. Nallaraiguda Watershed (IWMP-20/2013-14) Land Use and Land Cover changes for Pre and Post treatment dates

Plantation to Agriculture

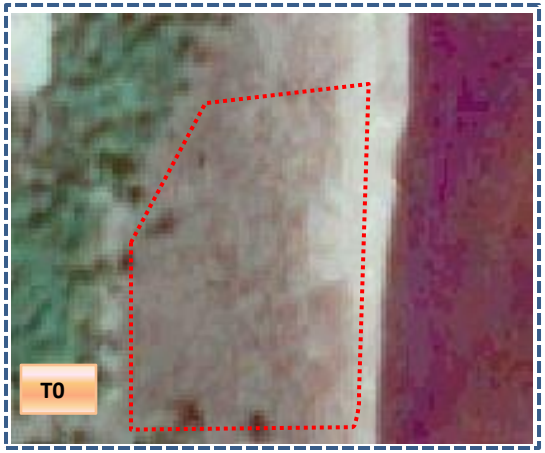


T0: 2013-14 (83°50'27.262"E 18°54'34.107"N)

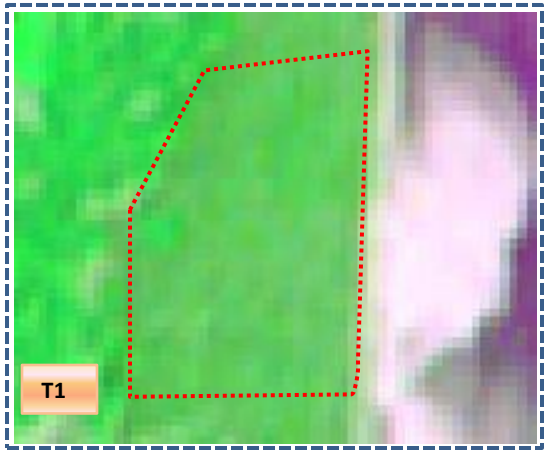


T1: 02 April 2018

Agriculture to Plantation



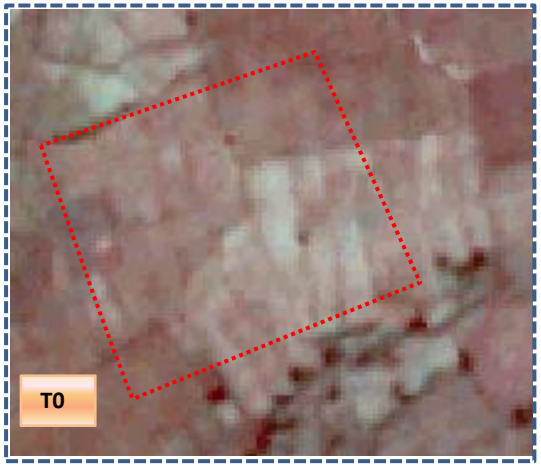
T1: 2013-14 (83°50'47.432"E 18°54'0.337"N)



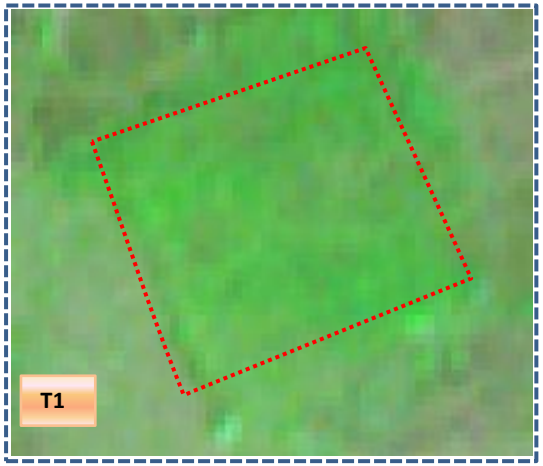
T2: 02 April 2018

Fig 6. Nallaraiguda Watershed (IWMP-20/2013-14) Land Use and Land Cover changes for Pre and Post treatment dates

Agriculture to Plantation

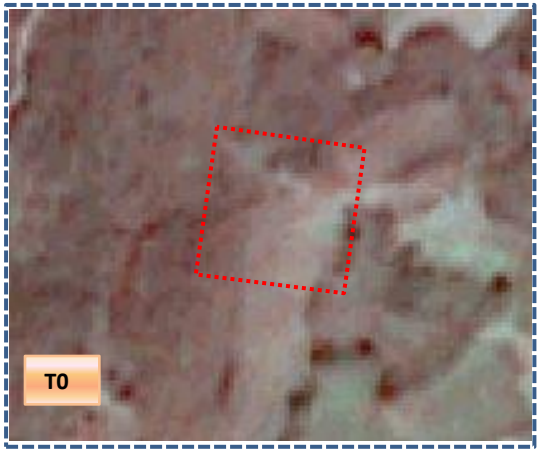


T0: 2013-14 (83°48'37.038"E 18°54'12.872"N)



T1: 02 April 2018

Scrub to Water body



T0: 2013-14 (83°48'16.487"E 18°55'1.061"N)

T1: 02 April 2018

Table 4. showing change matrix depicting Land cover transitions for Nallaraiguda Watershed (IWMP-20/2013-14) 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	80.98										**80.98**
Mining/dump											
Agriculture	11.54	7.07	2965.91	60.21	0.32			3.65	1.07	4.19	**3053.96**
Plantation Horticulture	1.66	0.13	73.8	395.04							**470.63**
Forest	0.06		113.55		1944.31						**2057.92**
Forest Plantation			3.06			363.38				0.04	**366.48**
Barren Rocky							1.17				**1.17**
Scrub	1.04		90.5	5.97				344.28	7.86	0.37	**450.02**
Waterbody-Streams/River									277.85		**277.85**
Waterbody – Ponds			0.76						4.72	84.78	**90.26**
Grand Total	**95.28**	**7.2**	**3247.58**	**461.22**	**1944.63**	**363.38**	**1.17**	**347.93**	**291.5**	**89.38**	**6849.27**

Interpretation: The example of "Agriculture" Land cover for the period of 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 88 ha of the agriculture area has decreased and it is converted into Built-up (11.5 ha), mining/dump (7 ha) plantation/horticulture (60ha), forest (0.3 ha), scrub (3 ha) and water body (5 ha) in T1.

3.In T1 281 ha of the agriculture area has increased from plantation/horticulture (73 ha), forest (113 ha), forest and scrubland of T0.

Table 5. showing change matrix depicting Land cover transitions for Nallaraiguda Watershed (IWMP-20/2013-14) 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	95.28										**95.28**
Mining/dump		7.2									**7.2**
Agriculture	4.7		3222.5							20.38	**3247.58**
Plantation Horticulture	1.14		6.29	453.62						0.17	**461.22**
Forest			58.96		1884.53	1				0.14	**1944.63**
Forest Plantation	0.04		3.21			359.99				0.14	**363.38**
Barren Rocky							1.17				**1.17**
Scrub			10.06					337.34	0.16	0.37	**347.93**
Waterbody-Streams/River									291.5		**291.5**
Waterbody – Ponds										89.38	**89.38**
Grand Total	**101.16**	**7.2**	**3301.02**	**453.62**	**1884.53**	**360.99**	**1.17**	**337.34**	**291.66**	**110.58**	**6849.27**

4. In T1 7.4 ha of the agriculture area has decreased and it is converted into Built-up (4.7 ha) and water body (20.3 ha) in T2.

5.In T2 235 ha of the agriculture area has increased from plantations (6.2 ha), forest (58.9 ha) and scrubland (10 ha) of T1.

Table 6. showing change matrix depicting Land cover transitions for Nallaraiguda Watershed (IWMP-20/2013-14) 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	101.16										**101.16**
Mining/dump		7.2									**7.2**
Agriculture	3.52	2.67	3127.6	155.74		4.33		0.54		6.62	**3301.02**
Plantation Horticulture	2.94	0.01	9.88	440.74						0.05	**453.62**
Forest	0.04		76.97		1797.2	10.32					**1884.53**
Forest Plantation			1.45			359.54					**360.99**
Barren Rocky							1.17				**1.17**
Scrub	0.12		10.65	4.76				319.98	1.06	0.77	**337.34**
Waterbody-Streams/River									291.66		**291.66**
Waterbody – Ponds	0.05		0.47	0.32						109.74	**110.58**
Grand Total	**107.83**	**9.88**	**3227.02**	**601.56**	**1797.2**	**374.19**	**1.17**	**320.52**	**292.72**	**117.18**	**6849.27**

6. In T2 173 ha of the agriculture area has decreased and it is converted into Built-up (3.5 ha), mining/dump (2.6 ha), plantations/horticulture (155 ha), forest plantation (4.3 ha), scrubland (0.5 ha) and water body (6.6 ha) in T3.

7. In T3 99 ha of the agriculture area has increased from plantations/horticulture (9.8 ha), forest (76.9 ha), forest plantation(1.4 ha) scrubland and water body (0.4 ha) of T2.

Table 7. showing change matrix depicting Land cover transitions for Nallaraiguda Watershed (IWMP-20/2013-14) 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	107.83										**107.83**
Mining/dump		9.88									**9.88**
Agriculture	1.54		3214.72							10.76	**3227.02**
Plantation Horticulture	0.15		7.86	593.55							**601.56**
Forest			30.7		1766.13					0.37	**1797.2**
Forest Plantation						373.97					**374.19**
Barren Rocky							1.17				**1.17**
Scrub			3.17					317.35			**320.52**
Waterbody-Streams/River			0.76						291.96		**292.72**
Waterbody – Ponds										117.18	**117.18**
Grand Total	**109.52**	**9.88**	**3257.21**	**593.55**	**1766.13**	**373.97**	**1.17**	**317.35**	**291.96**	**128.31**	**6849.27**

8. In T3 173 ha of the agriculture area has decreased and it is converted into Built-up (1.5 ha) and water body (10.7 ha) in T4.

9. In T4 99 ha of the agriculture area has increased from plantations/horticulture (7.8 ha), forest (30.7 ha) scrubland (3.7 ha) and water body (0.7 ha) of T3.

Table 8. showing change matrix depicting Land cover transitions for Nallaraiguda Watershed (IWMP-20/2013-14) 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	109.52										**109.52**
Mining/dump		9.88									**9.88**
Agriculture	2.16	0.14	3246.33	7.86						0.72	**3257.21**
Plantation Horticulture	0.48		31.71	561.36							**593.55**
Forest			92.5		1673.63						**1766.13**
Forest Plantation						373.97					**373.97**
Barren Rocky							1.17				**1.17**
Scrub			16.14					301.21			**317.35**
Waterbody-Streams/River									291.96		**291.96**
Waterbody – Ponds										128.31	**128.31**
Grand Total	**112.16**	**10.02**	**3386.68**	**569.22**	**1673.63**	**373.97**	**1.17**	**301.21**	**291.96**	**129.03**	**6849.27**

10. In T4 10 ha of the agriculture area has decreased and it is converted into Built-up (2.1 ha), mining/dump (0.14 ha), plantation/horticulture (7.8 ha) and water body (0.7 ha) in T5.

11. In T5 140 ha of the agriculture area has increased from plantations/horticulture (31.7 ha), forest (92 ha) and scrubland (16 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 52 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, 53, 30 and 129 Hectares from T0-T1, T1-T2, T3-T4 & T4-T5 respectively and overall increase of 332 Hectares in Crop land area as compared between baseline Land Use/Land Cover data 2013-14 (T0) & 2021-22 (T5) years.
4. About **98 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 148 Hectares in Scrubland area as compared between 2013-14 (T0) & 2021-22 (T5) years.
6. Farm ponds (02) is visible on (Integrated Watershed Management Programme) Bhuvan Srishti portal out of Bhuvan Drishti photo of Farm ponds (02) 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