MONITORING OF IWMP WATERSHED PROJECTS USING GEO-INFORMATION

SUMMARY REPORT

IWMP-Batch-V

VISAKHAPATNAM -04/2013-14
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

C O N T E N T S

E X E C U T I V E   S U M M A R Y

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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-04/2013-14, Visakhapatnam District of Andhra Pradesh.   The total geographical area of the project is 8,450 ha. It comprises of 20 micro watersheds.

4. In the project area 37 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 7.4 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. 45 % is covered by the agriculture, 32 % is covered by forest, 14 % is covered by scrubland and remaining by other land use classes.

- The study area falls in Paderu Mandal of Visakhapatnam district of Andhra Pradesh state. The total geographical area of the project is 8,450 ha. It comprises of 20 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.
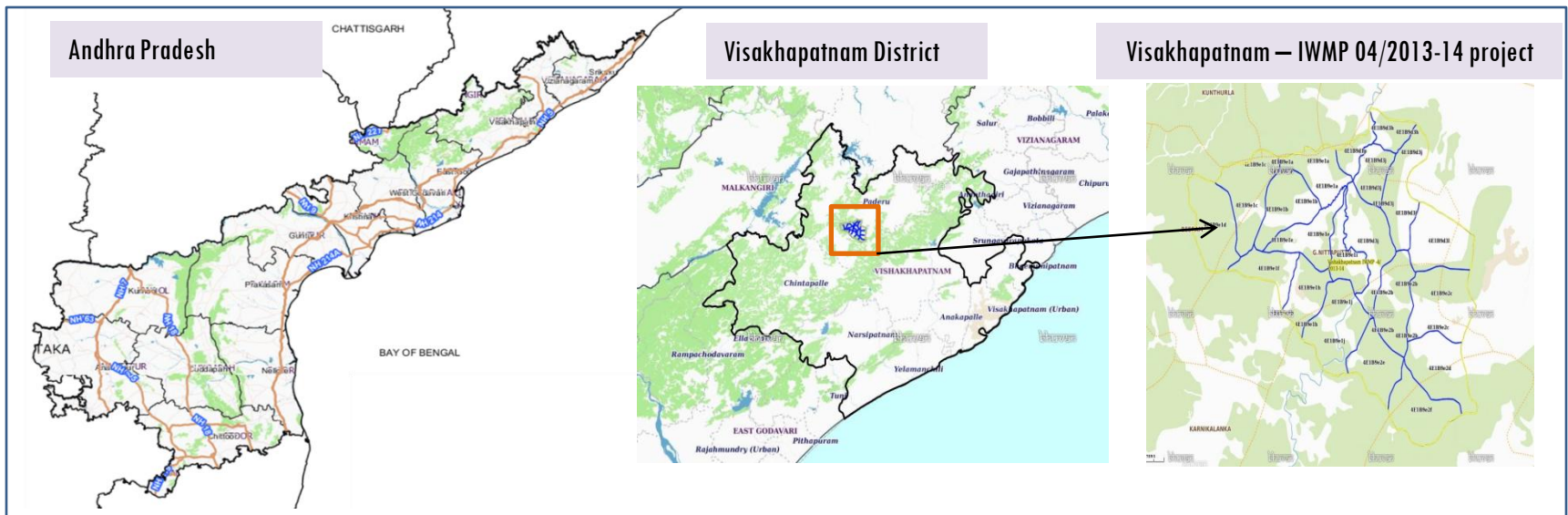

Fig.1. Location map of Barsingi Watershed (IWMP-04/2013-14) in Visakhapatnam District, A.P

- 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			14-Feb-22
SCENE2			
SCENE 3			
SCENE 4			
CARTO	2013-14		
SCENE 1			14-Feb-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	37
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	23	23
9	Gabion structure	0	0
10	Farm ponds/Dug out pit	0	0
11	Civil work-Check dams/Rock fill dam	6	6
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	8	8
18	Others	0	0
	TOTAL	**37**	**37**

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.

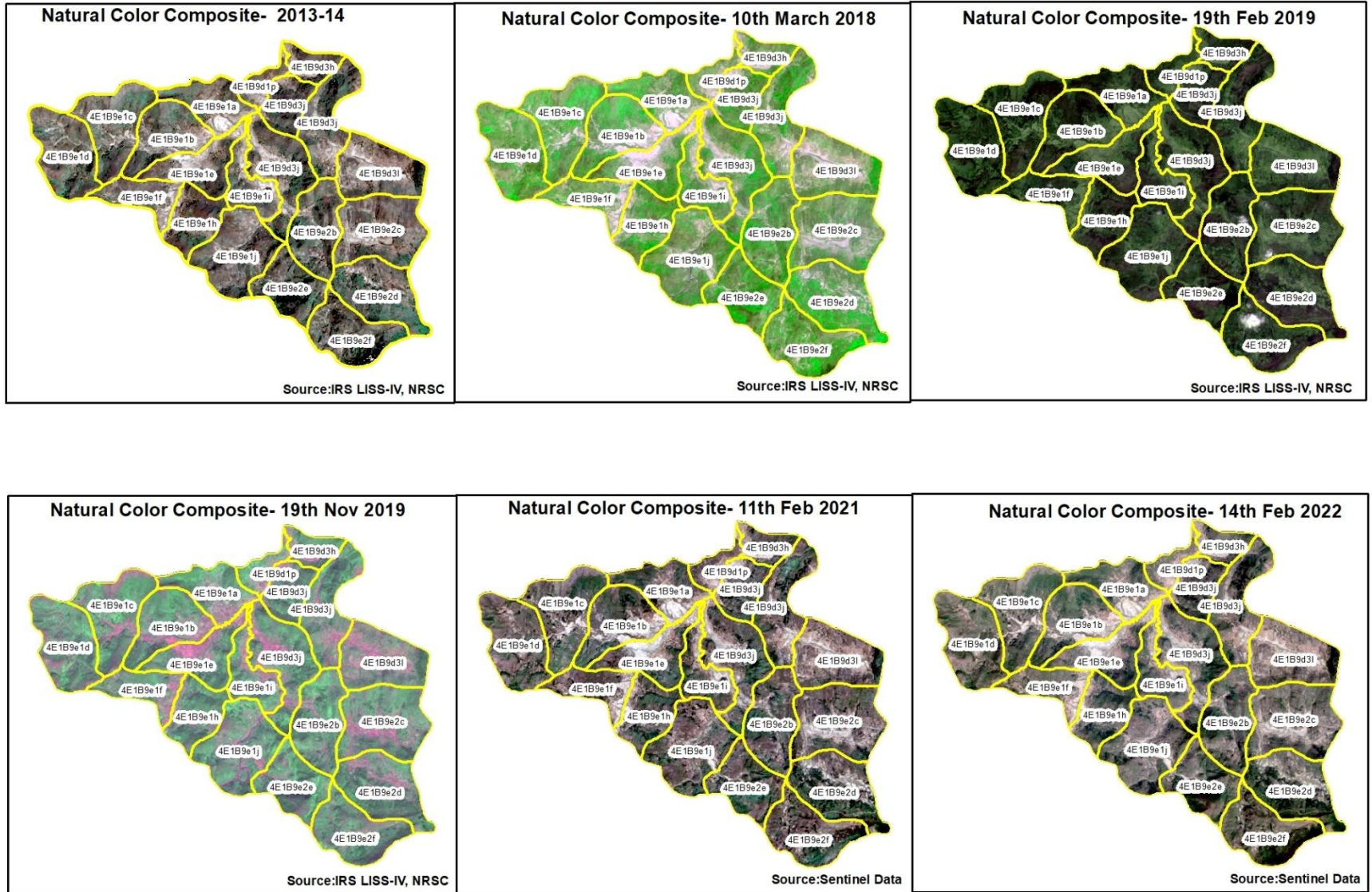# Fig 4. Barsingi Watershed (IWMP-04/2013-14) Natural Colour Composite (NCC)

Fig 5. Monitoring of activities in Barsingi Watershed (IWMP-04/2013-14) Visakhapatnam District Andhra Pradesh
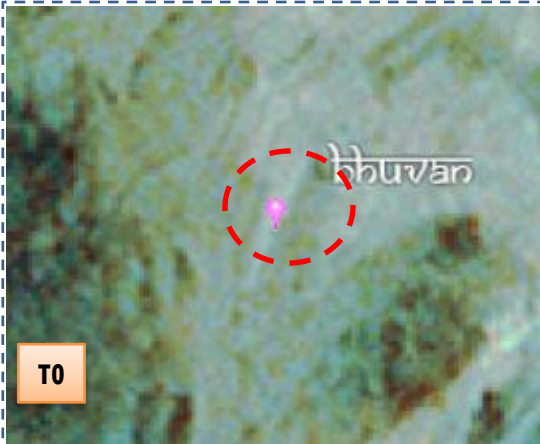

T0:2013-14

T1: 25 November 2017

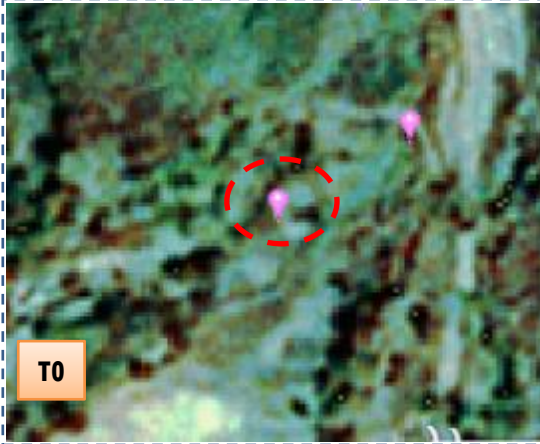Drishti Sl no. 1922380   MWS : 4E1B9e1b

Farm pond

T0:2013-14

T1: 25 November 2017

Drishti Sl no. 1922381   MWS : 4E1B9e2c

Farm pond

Fig 6. Monitoring of activities in Barsingi Watershed (IWMP-04/2013-14) Visakhapatnam District Andhra Pradesh
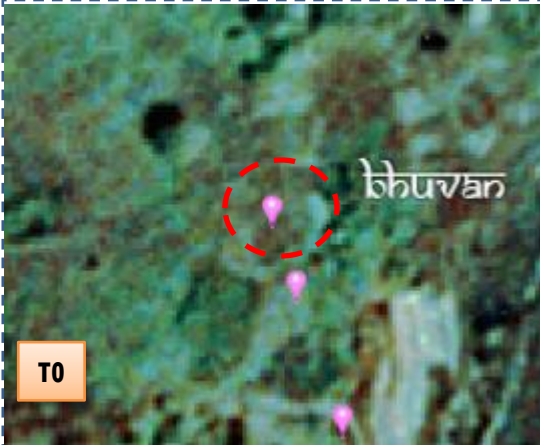

| T0: 2013-14 | T1: 25 November 2017 | Drishti Sl no. 2318173   MWS : 4E1B9e1c |

Farm pond

| T0: 2013-14 | T1: 25 November 2017 | Drishti Sl no. 2318237   MWS : 4E1B9e1c |

Loose Boulder

03. MONITORING IN THE PROJECT AREA

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. Barsingi Watershed (IWMP-04/2013-14) Comparative assessment of Land Use and Land Cover for Pre and Post IWMP implementation (2013-14 to 2017-18)

Scale: 1:10000

Fig 8. Barsingi Watershed (IWMP-04/2013-14) Comparative assessment of Land Use and Land Cover for Pre and Post IWMP implementation (2017-18 to 2018-19)
Scale: 1:10000

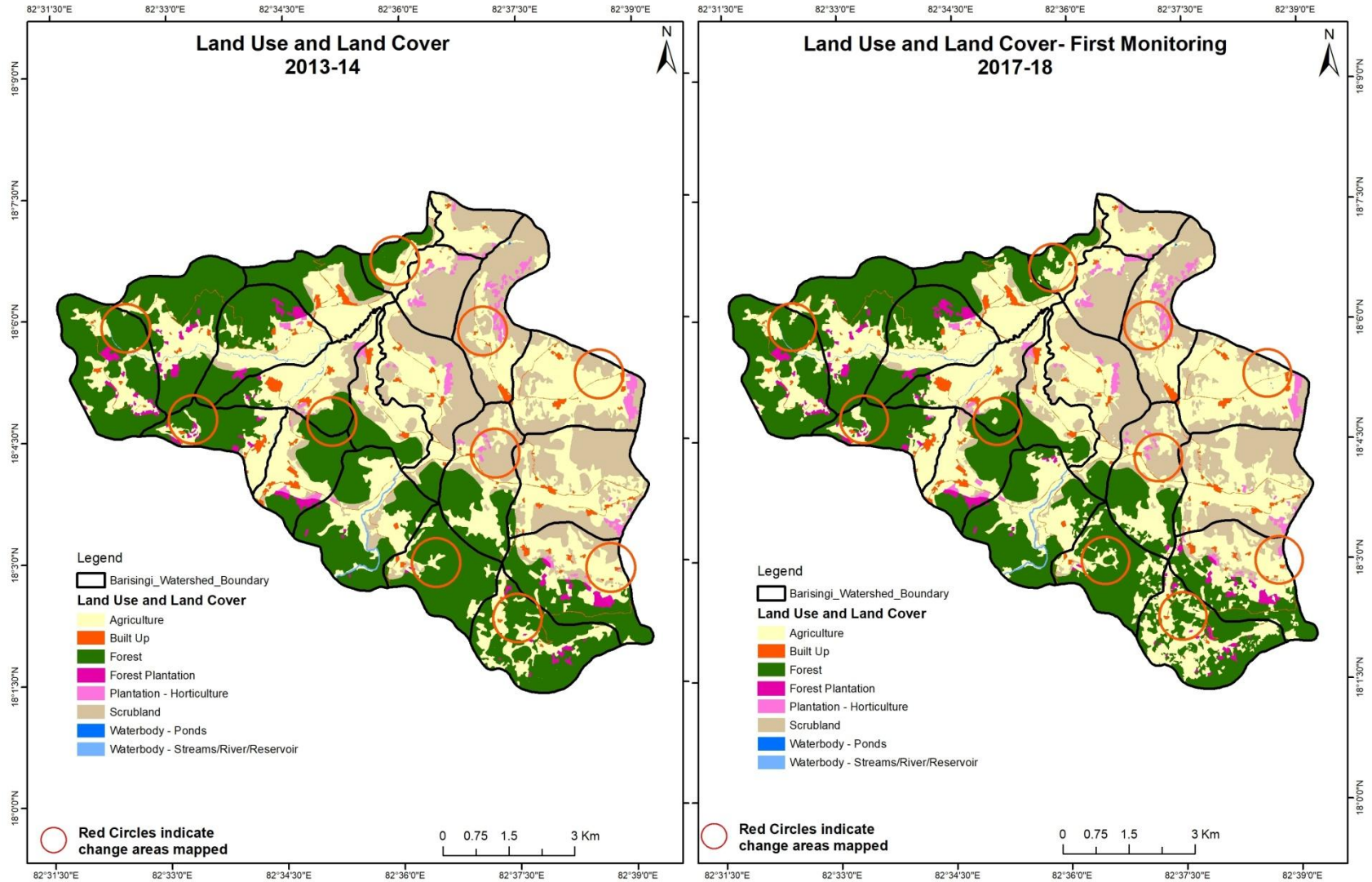# Fig 9. Barsingi Watershed (IWMP-04/2013-14) Comparative assessment of Land Use and Land Cover for Pre and Post IWMP implementation (2018-19 to 2019-20)

Scale: 1:10000

Land Use and Land Cover 2018-19

Land Use and Land Cover- Third Monitoring 2019-20

Legend
Barisingi_Watershed_Boundary
Land Use and Land Cover
- Agriculture
- Built Up
- Forest
- Forest Plantation
- Plantation - Horticulture
- Scrubland
- Waterbody - Ponds
- Waterbody - Streams/River/Reservoir

Red Circles indicate change areas mapped

0 0.75 1.5   3 Km

Fig 10. Barsingi Watershed (IWMP-04/2013-14) Comparative assessment of Land Use and Land Cover for Pre and Post IWMP implementation (2019-20 to 2020-21)

Scale: 1:10000

Land Use and Land Cover 2019-20

Land Use and Land Cover- Fourth Monitoring 2020-21

Legend

Barisingi_Watershed_Boundary

Land Use and Land Cover

- Agriculture
- Built Up
- Forest
- Forest Plantation
- Plantation - Horticulture
- Scrubland
- Waterbody - Ponds
- Waterbody - Streams/River/Reservoir

Red Circles indicate change areas mapped
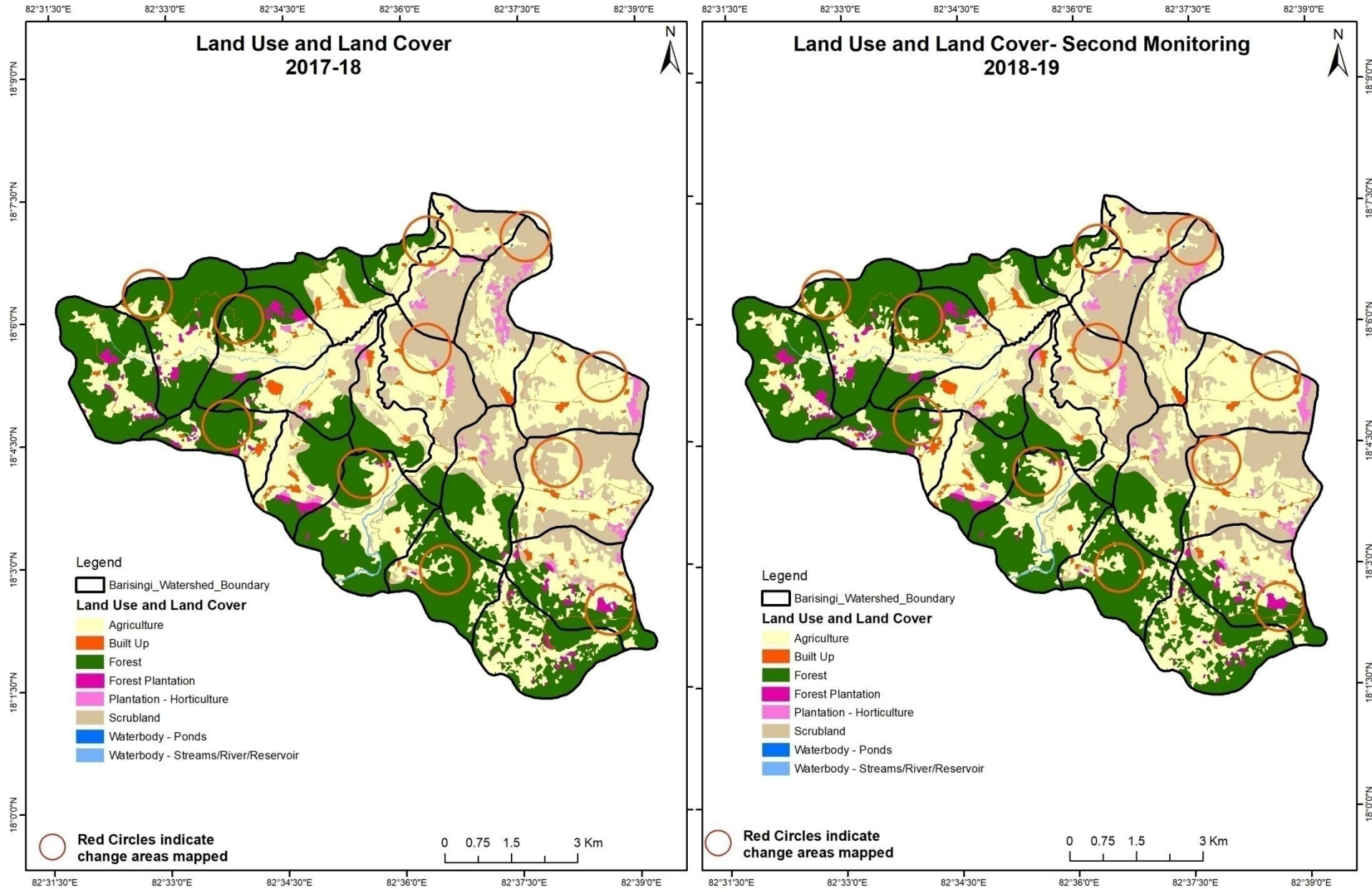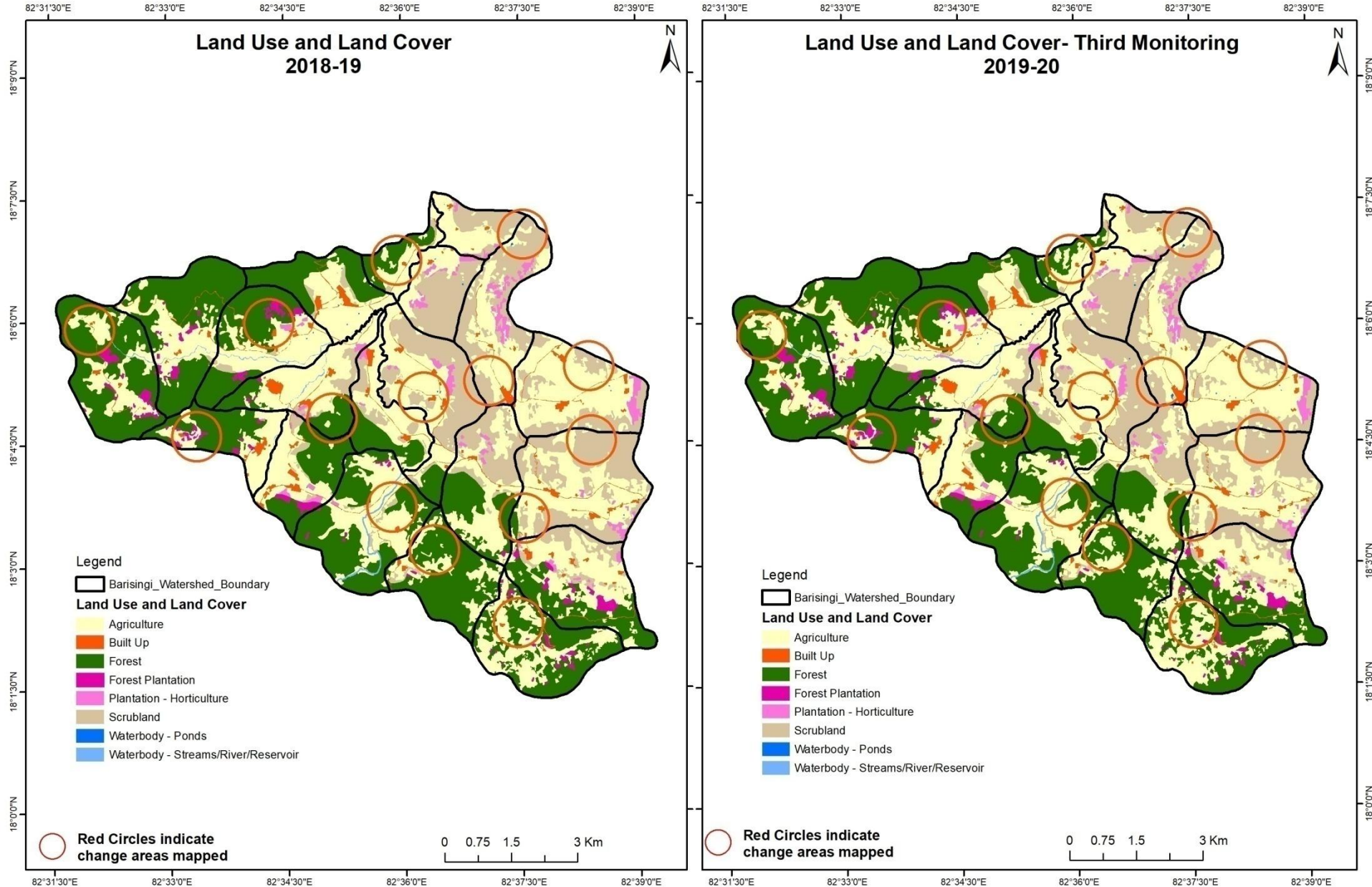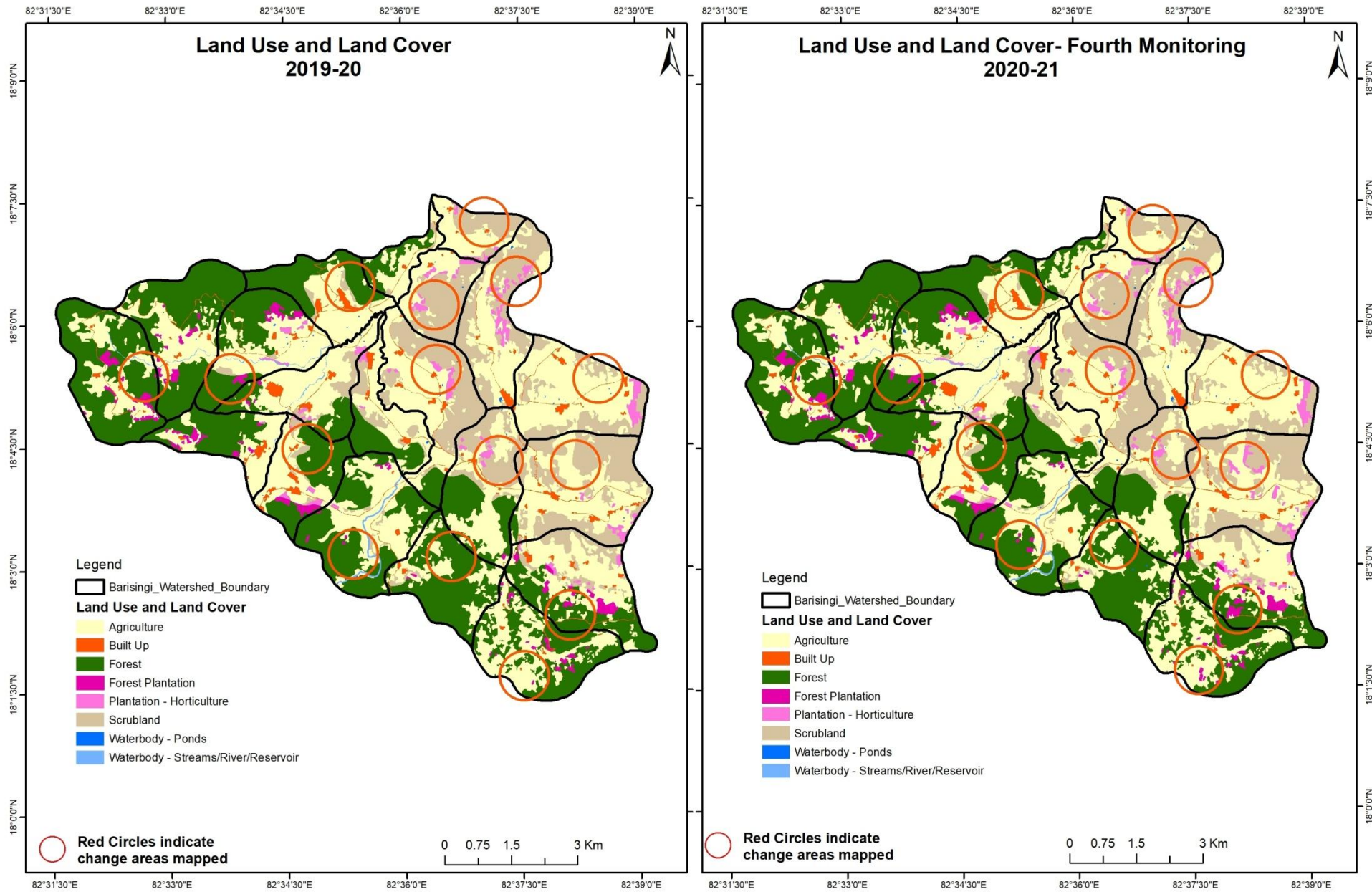
0   0.75   1.5   3 Km

Fig 11. Barsingi Watershed (IWMP-04/2013-14) Comparative assessment of Land Use and Land Cover for Pre and Post IWMP implementation (2020-21 to 2021-22)
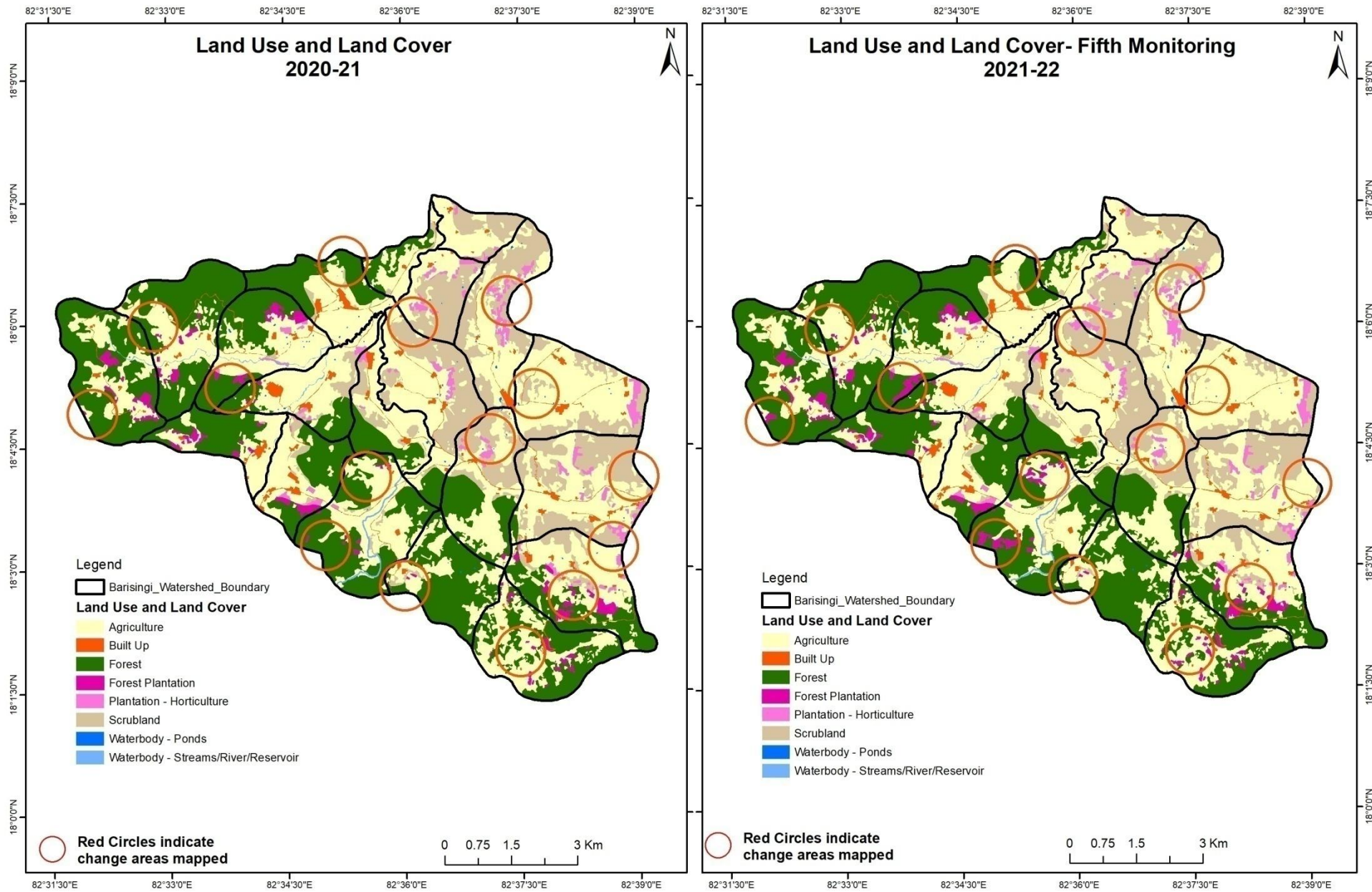
Scale: 1:10000

Fig 12. Barsingi Watershed (IWMP-04/2013-14) Land Use and Land Cover changes for Pre and Post treatment dates

Agriculture to Plantation

T0: 2013-14 (82°38'16.199"E 18°3'51.686"N)

T1: 28 March 2018

Scrub to Agriculture

T0: 2013-14 (82°36'51.701"E 18°6'16.077"N)

T1: 28 March 2018

Fig 13. Barsingi Watershed (IWMP-04/2013-14) Land Use and Land Cover changes for Pre and Post treatment dates

Forest to Agriculture

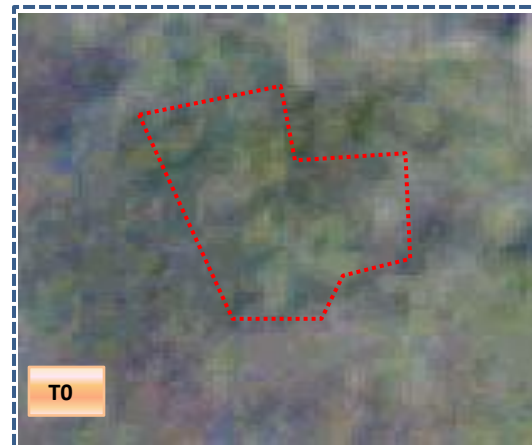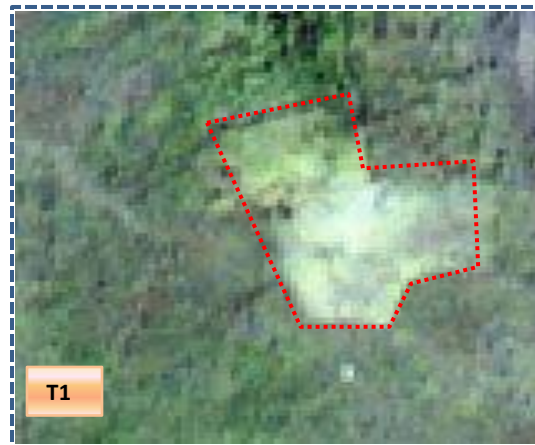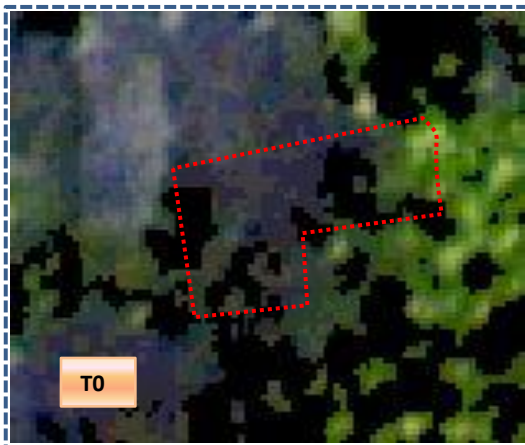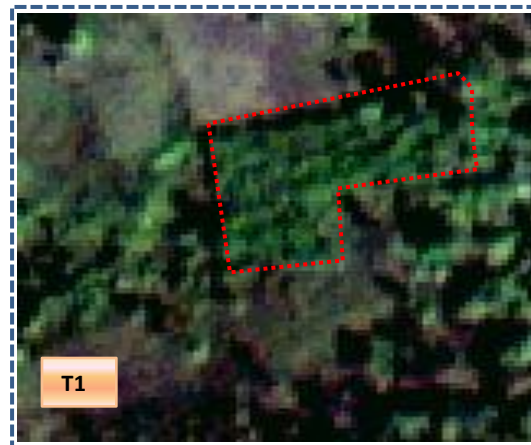T0: 2013-14 (82°36'58.484"E 18°2'16.308"N)

T1: 28 March 2018

Forest to Forest Plantation

T0: 2013-14 (82°37'47.531"E 18°1'33.375"N)

T1: 28 March 2018

Table 4. showing change matrix depicting Land cover transitions for Barsingi Watershed (IWMP-04/2013-14) 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	196.43										**196.43**
Mining/dump											
Agriculture	2.95		2874.83	4.56		4.2				0.31	**2886.85**
Plantation Horticulture	0.39		2.72	138.15							**141.26**
Forest	0.12		224.98		3038.88	10.08				0.15	**3274.21**
Forest Plantation			3.95		1.14	104.64					**109.73**
Barren Rocky											
Scrub	0.31		196.55	4.78				1575.82			**1777.46**
Waterbody-Streams/River									63.8		**63.8**
Waterbody – Ponds										0.6	**0.6**
Grand Total	**200.2**		**3303.03**	**147.49**	**3040.02**	**118.92**		**1575.82**	**63.8**	**1.06**	**8450.34**

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 7.8 ha of the agriculture area has decreased and it is converted into Built-up (2.9 ha), plantation/horticulture (4.5 ha), forest-plantation (4.2 ha) and water body (0.31 ha) in T1.

3. In T1 428 ha of the agriculture area has increased from plantations/horticulture (2.7 ha), forest (224 ha), forest-plantation(3.9 ha) and scrubland (196 ha) of T0.

Table 5. showing change matrix depicting Land cover transitions for Barsingi Watershed (IWMP-04/2013-14) during study period-2017-18 to 2018-19

T1	Monitoring period (T2) Built up	Mining/ dump	Agriculture	Plantation Horticulture	Forest	Forest Plantation	Barren Rocky	Scrub	Waterbody-Streams/River	Water body Ponds	Units in Hectares Grand Total
Built up	200.2										200.2
Mining/dump											
Agriculture			3300.28			1.94				0.81	3303.03
Plantation Horticulture			0.31	147.18							147.49
Forest			103.21		2928.75	8.06					3040.02
Forest Plantation			3.15			115.77					118.92
Barren Rocky											
Scrub			53.57	1.46				1520.61		0.18	1575.82
Waterbody-Streams/River									63.8		63.8
Waterbody – Ponds										1.06	1.06
Grand Total	200.2		3460.52	148.64	2928.75	125.77		1520.61	63.8	2.05	8450.34

4. In T1 2.75 ha of the agriculture area has decreased and it is converted into forest-plantations (1.9 ha) and water body (0.81 ha) in T2.

5.In T2 160 ha of the agriculture area has increased from plantations/horticulture (0.31 ha), forest (103 ha), forest-plantation (3.15 ha) and scrubland (53 ha) of T1.

Table 6. showing change matrix depicting Land cover transitions for Barsingi Watershed (IWMP-04/2013-14) 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	200.2										**200.2**
Mining/dump											
Agriculture	0.19		3453.48	2.62		2.52				1.71	**3460.52**
Plantation Horticulture			0.26	148.38							**148.64**
Forest			87.9		2840.77					0.08	**2928.75**
Forest Plantation						125.77					**125.77**
Barren Rocky											
Scrub			68.97	2.63				1448.33		0.68	**1520.61**
Waterbody-Streams/River									63.8		**63.8**
Waterbody – Ponds										2.05	**2.05**
Grand Total	**200.39**		**3610.61**	**153.63**	**2840.77**	**128.29**		**1448.33**	**63.8**	**4.52**	**8450.34**

6. In T2 07 ha of the agriculture area has decreased and it is converted into Built-up (0.19 ha), plantations/horticulture (2.6 ha), forest-plantation (2.5 ha) and water body (1.7 ha) in T3.

7. In T3 157 ha of the agriculture area has increased from plantations/horticulture (0.26 ha), forest (87 ha) and scrubland (69 ha) of T2.

Table 7. showing change matrix depicting Land cover transitions for Barsingi Watershed (IWMP-04/2013-14) during study period-2019-20 to 2020-21

T3	Monitoring period (T4) Built up	Mining/dump	Agriculture	Plantation Horticulture	Forest	Forest Plantation	Barren Rocky	Scrub	Waterbody-Streams/River	Water body Ponds	Grand Total
Built up	200.39										200.39
Mining/dump											
Agriculture	0.09		3597.56	3.55		6.87				2.54	3610.61
Plantation Horticulture			1.62	152.01							153.63
Forest			62.18		2770.89	7.27				0.43	2840.77
Forest Plantation						128.29					128.29
Barren Rocky											
Scrub			71.03	23				1353.79		0.51	1448.33
Waterbody-Streams/River									63.8		63.8
Waterbody – Ponds										4.52	4.52
Grand Total	200.48		3732.39	178.56	2770.89	142.43		1353.79	63.8	8	8450.34

Units in Hectares

8. In T3 13 ha of the agriculture area has decreased and it is converted into built-up (0.09 ha), plantations/horticulture (3.5 ha), forest/plantation (6.8 ha) and water body (2.5 ha) in T4.

9. In T4 134.8 ha of the agriculture area has increased from plantations/horticulture (1.6 ha), forest (62 ha) and scrubland (71 ha) of T3.

Table 8. showing change matrix depicting Land cover transitions for Barsingi Watershed (IWMP-04/2013-14) 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	200.48										200.48
Mining/dump											
Agriculture			3725.25	1.67		4.75		0.69		0.03	3732.39
Plantation Horticulture			0.31	178.25							178.56
Forest			35.51		2703.87	31.49				0.02	2770.89
Forest Plantation			1.71			140.72					142.43
Barren Rocky											
Scrub			79.19	11.7				1262.9			1353.79
Waterbody-Streams/River									63.8		63.8
Waterbody – Ponds										8	8
Grand Total	200.48		3841.97	191.62	2703.87	176.96		1263.59	63.8	8.05	8450.34

10. In T4 7.14 ha of the agriculture area has decreased and it is converted into plantations/horticulture (1.6 ha), forest-plantation (4.7 ha), scrubland (0.69 ha) and water body (0.03 ha) in T5.

11. In T5 116 ha of the agriculture area has increased from plantations/horticulture (0.31 ha), forest (35.5 ha), forest-plantation (1.7 ha) and scrubland (79 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 7.45 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 416, 157, 150, 121 & 109 Hectares from T0-T1, T1-T2, T2-T3, T3-T4 & T4-T5 respectively and overall increase of 955 Hectares in Crop land area as compared between baseline Land Use/Land Cover data 2013-14 (T0) & 2021-22 (T5) years.

4. About **50 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 513 Hectares in Scrubland area as compared between 2013-14 (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