MONITORING OF IWMP WATERSHED PROJECTS USING GEO-INFORMATION

SUMMARY REPORT

IWMP-Batch-V

Vizianagaram -6/2013-14
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
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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-6/2013-14, Vizianagaram District of Andhra Pradesh. The total geographical area of the project is **6,554** ha. It comprises of 16 micro watersheds.
4. In the project area 150 Drishti photos were uploaded showing all water harvesting structures of check dams/Rock fill dam, recharge pits etc,.
5. Project area as per image analysis has witnessed distinguishable increase in farm ponds, showing new farm ponds or dug out pits and check dams and drainage treatments with 14.15 ha increase in the area.
6. Major percentage i.e. 50% is covered by the Agriculture, 19% is covered by Forest and 16 % is covered by Plantation , 11 % is covered by the scrubland and remaining by other land use classes.

STUDY AREA
PROJECT : DUGGERU WATERSHED – IWMP-6/2013-14
DISTRICT : VIZIANAGARAM, STATE : ANDHRA PRADESH

- The study area falls in Makkuva and Salur Mandals of Vizianagaram district of Andhra Pradesh state. The total geographical area of the project is **6,554** ha. It comprises of 16 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.

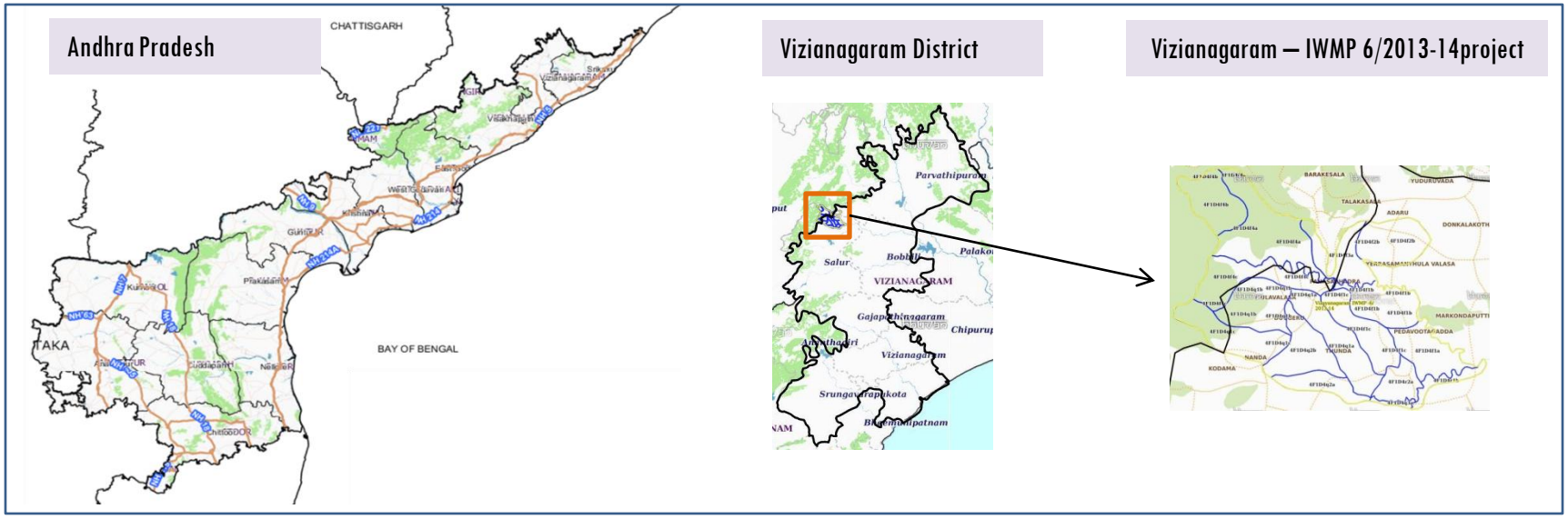


Fig.1. Location map of Duggeru Watershed (IWMP-03/2013-14) in Vizianagaram, A.P

- The climate of the district is dry and healthy. Out of 66 mandals in the district, 31 are upland mandals which are located in Madanapalle division and are comparatively cooler than the eastern mandals except Chittoor mandal where the climate is moderate. December and January are the coldest months when the mean maximum temperature will be around 26.40 °C, May is the hottest month with the mean daily maximum temperature rising above 40 °C.
- The district receive 83.62 percent of rainfall during South-West monsoon and North-West monsoon period, the rainfall is nominal in summer. On an average the district receives more than 50 percent of rainfall during North- East monsoon.

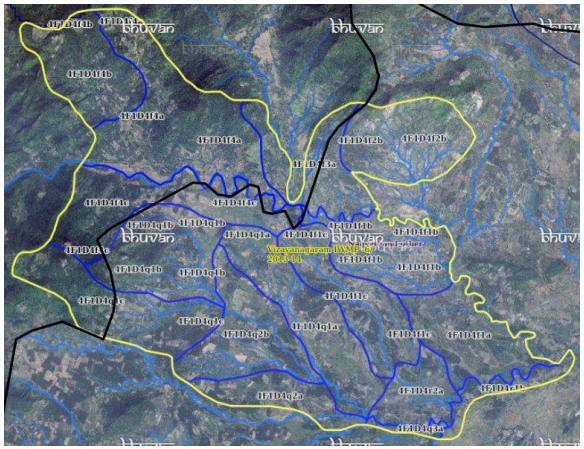
Table 1. Satellite Data and Ancillary Data

Satellite data*	T0-A**	T0-B**	T5
	2013-14	2011-12	2021-22
LISS IV	2013-14		
SCENE 1			29-Oct-21
SCENE2			
SCENE 3			
SCENE 4			
CARTO	2013-14		
SCENE 1			29-Oct-21
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	150
4	Detailed Project Report		

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



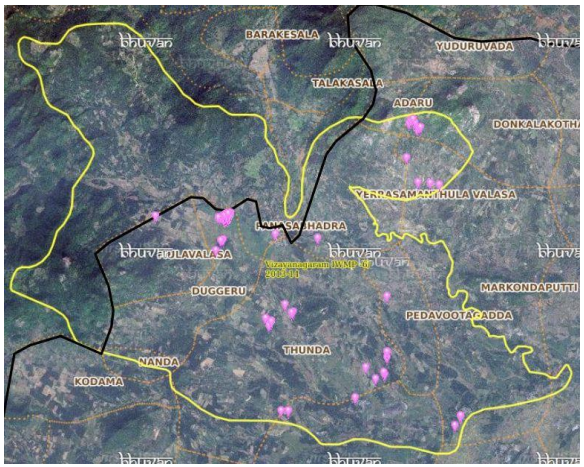
Legend

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	Agriculture	1	1
2	Bunding	0	0
3	Black planting	0	0
4	Bund Planting/Horticulture	0	0
5	Trench	0	0
6	Field Bunds	0	0
7	Existing activity	0	0
8	Checks & Plugs	17	17
9	New activity (boulder removal, farm ponds, dug out pits etc.,)	0	0
10	Farm ponds/Dug out pit	0	0
11	Civil work-Check dams /Rock fill dam	16	15
12	Drainage treatment /Nala Revetment, loose boulder structure, gully check	0	0
13	Land Developments (afforestation, horticulture and bund plantation of teak)	0	0
14	Lm (fodder development, varmi compost)	0	0
15	Livelihood Activities (Horticulture)	0	0
16	Water harvesting structures (recharge pits and check dams)	0	0
17	Entry Point Activity (Cattle thought)	9	9
18	Others	119	108
	TOTAL	**162**	**150**

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. Duggeru Watershed (IWMP-06/2013-14) Natural Color Composite-2013-14 TO 2021-22

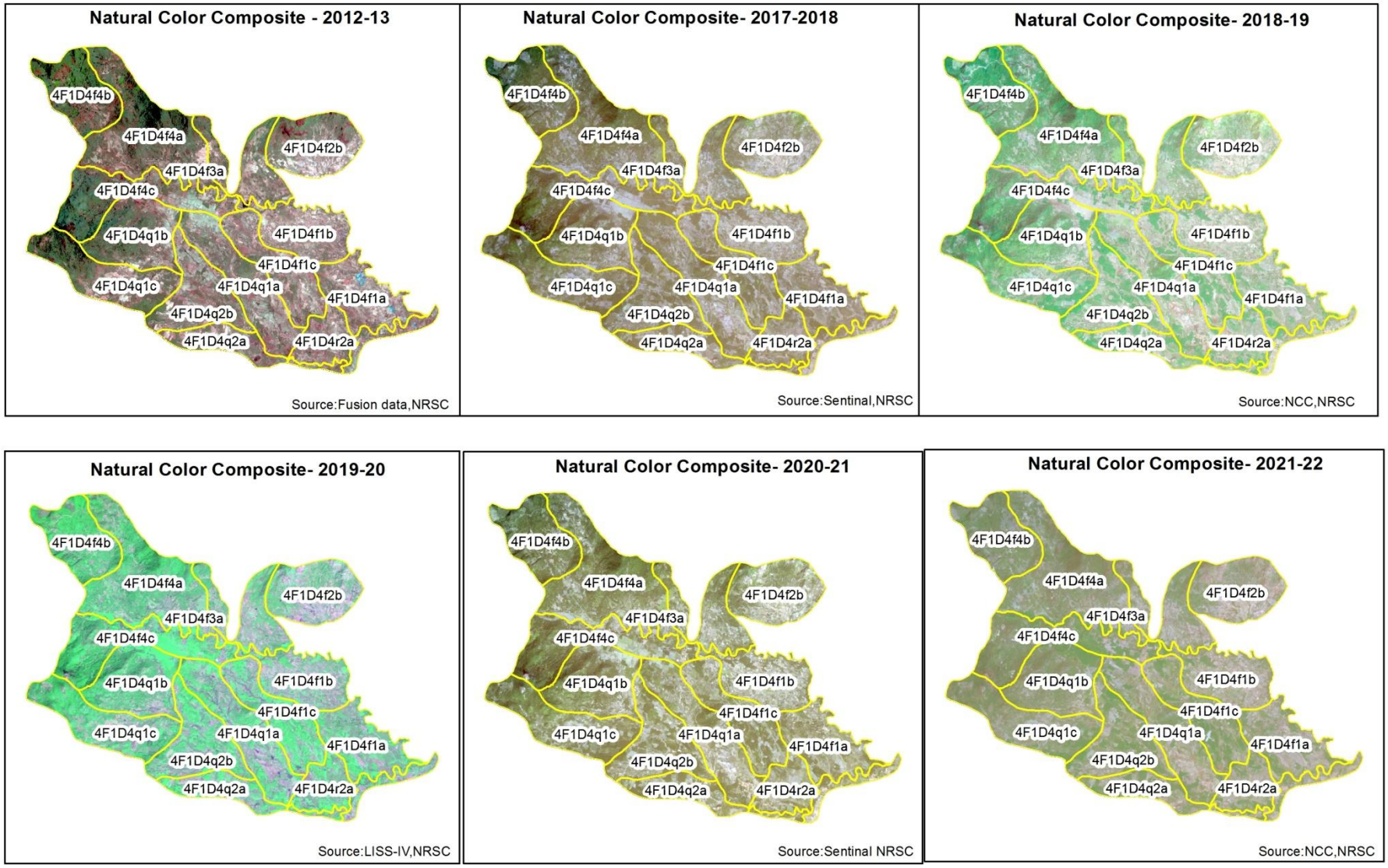


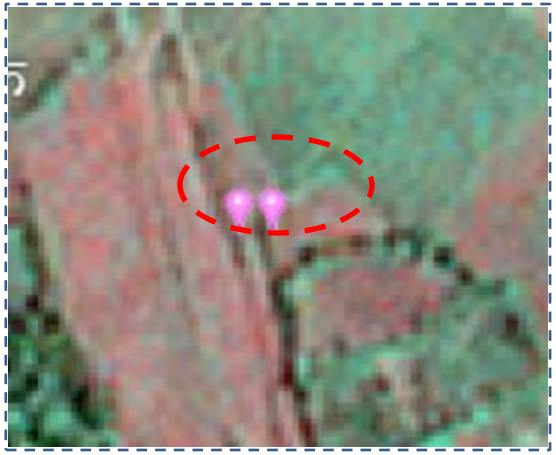
Fig 5. Monitoring of activities in Duggeru Watershed (IWMP-06/2013-14) ,Vizianagaram District, Andhra Pradesh

T0:2013-14

T1: 27 November 2017

Drishti Sl no. 2424856 MWS :4F1D4f1c

Farm pond



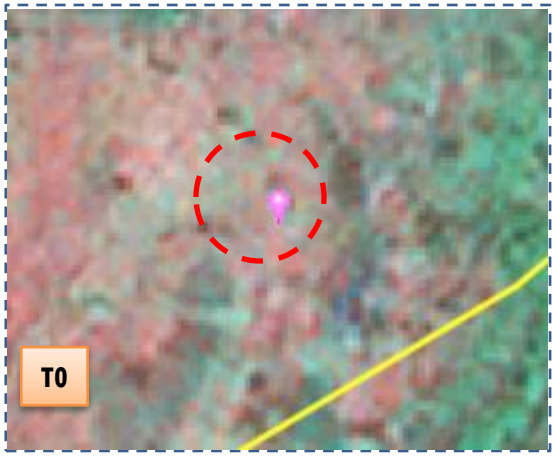
T0:2013-14

T1: 27 November 2017

Drishti Sl no. 7022213 MWS :4F1D4f1c

Farm pond

Fig 6. Monitoring of activities in Duggeru Watershed (IWMP-06/2013-14) ,Vizianagaram District, Andhra Pradesh

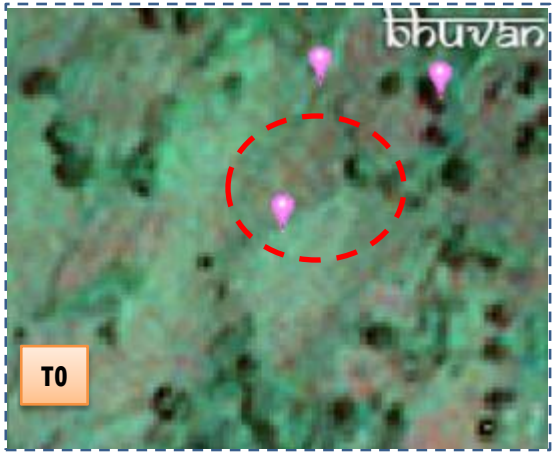


T0:2013-14

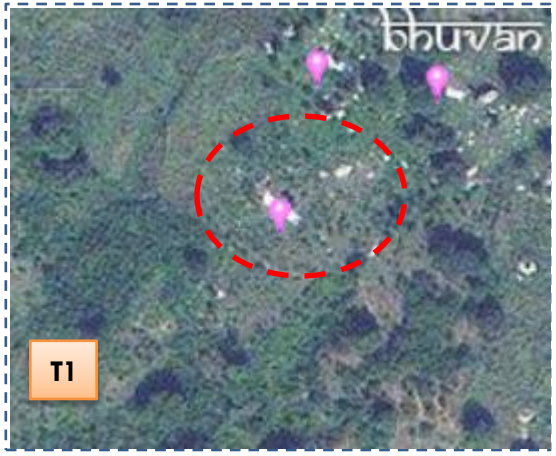
T1: 27 November 2017

Drishti Sl no. 7012713 MWS : 4F1D4f2b

Farm pond



T0:2013-14



T1: 27 November 2017

Drishti Sl no. 7010585 MWS :4F1D5f2e

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. Duggeru Watershed (IWMP-06/2013-14) Comparative assessment of Land Use and Land Cover for Pre and Post IWMP implementation (2013-14 to 2017-18)

Scale: 1:10000

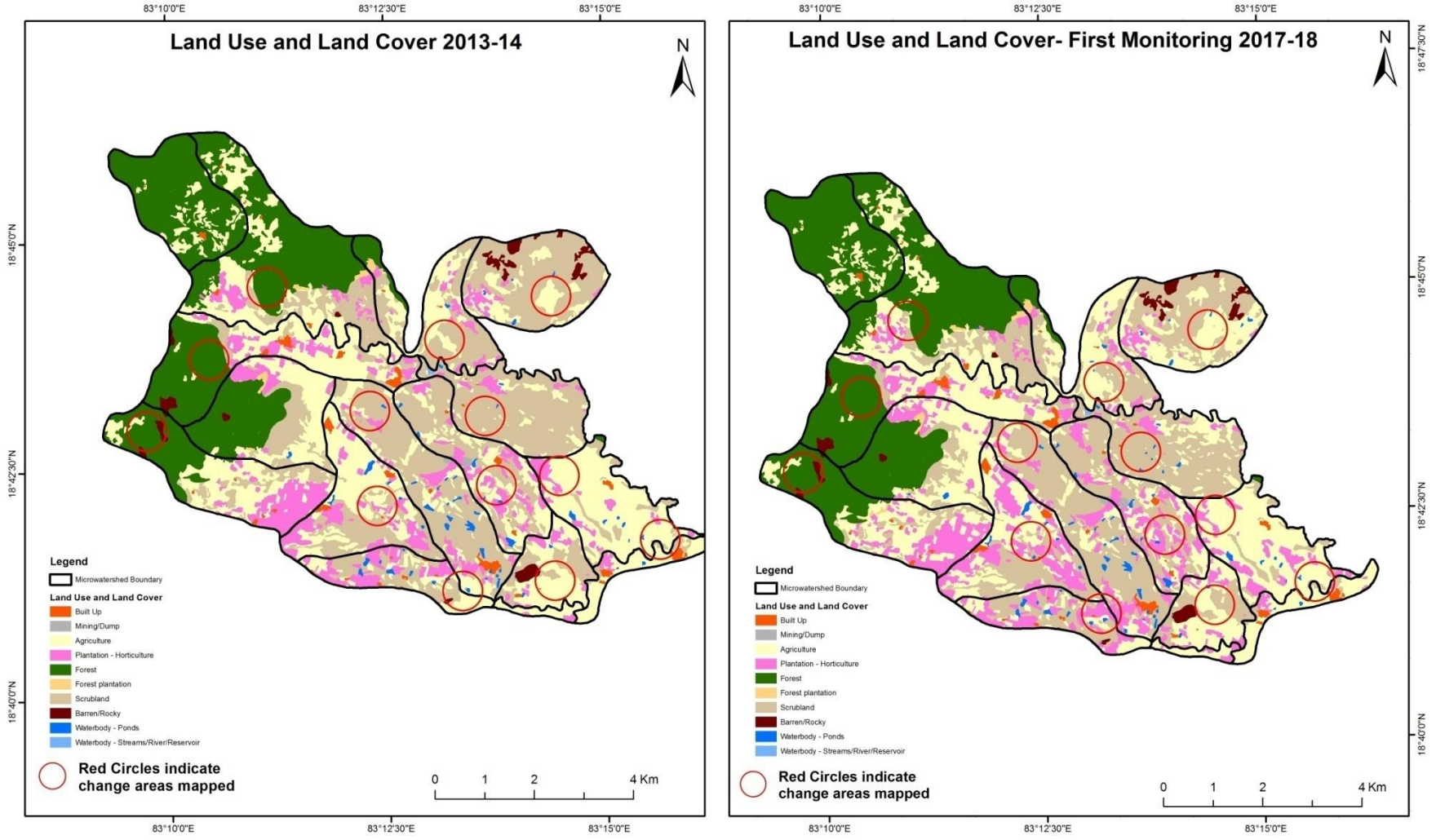
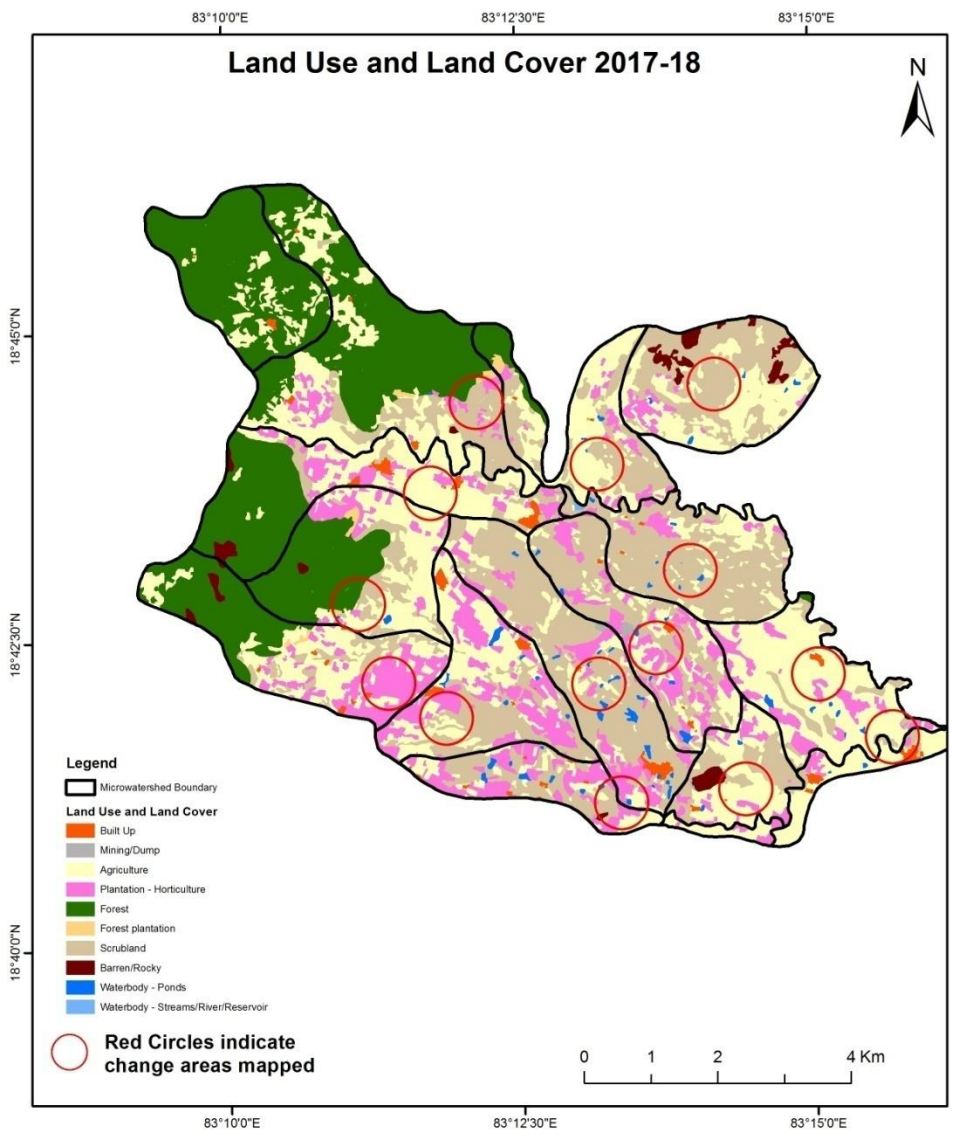


Fig 8. Duggeru Watershed (IWMP-06/2013-14) Comparative assessment of Land Use and Land Cover for Pre and Post IWMP implementation (2017-18 to 2018-19)

Scale: 1:10000



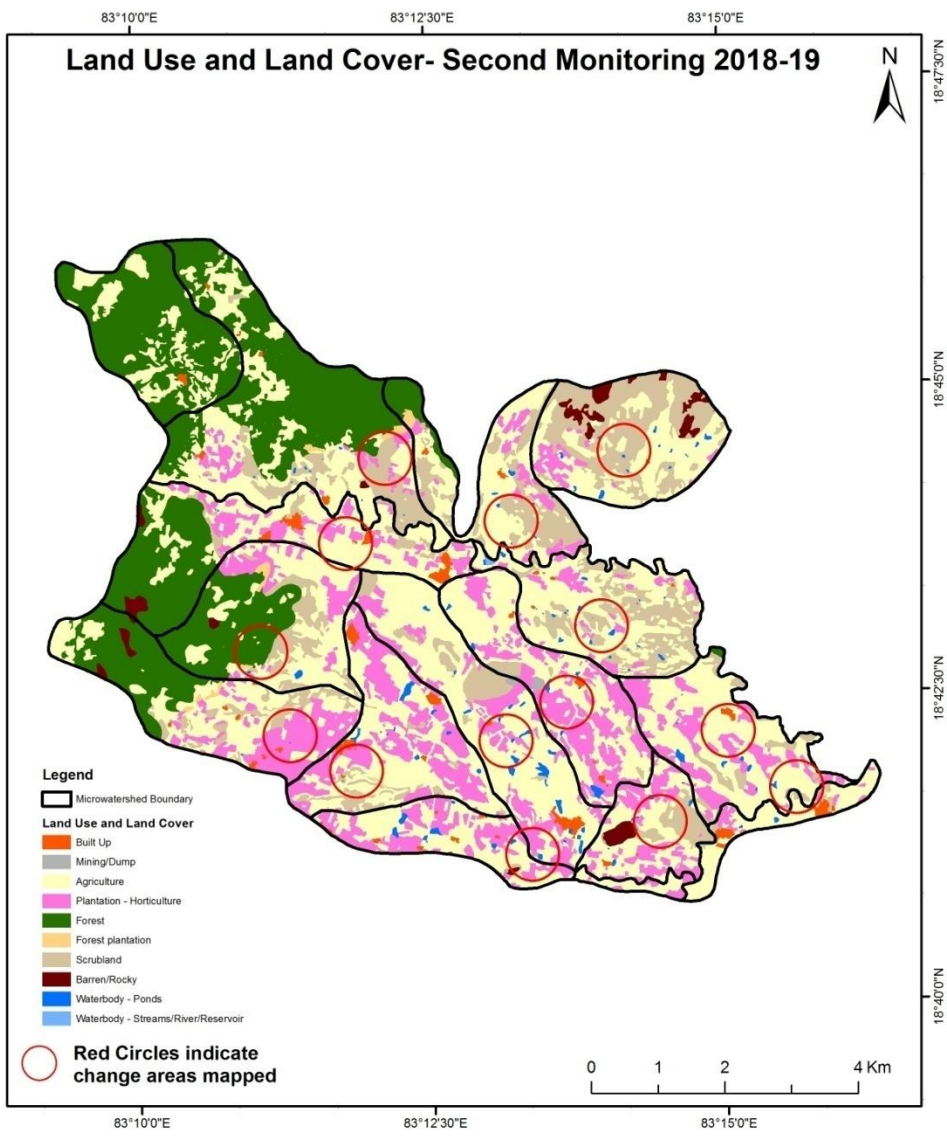
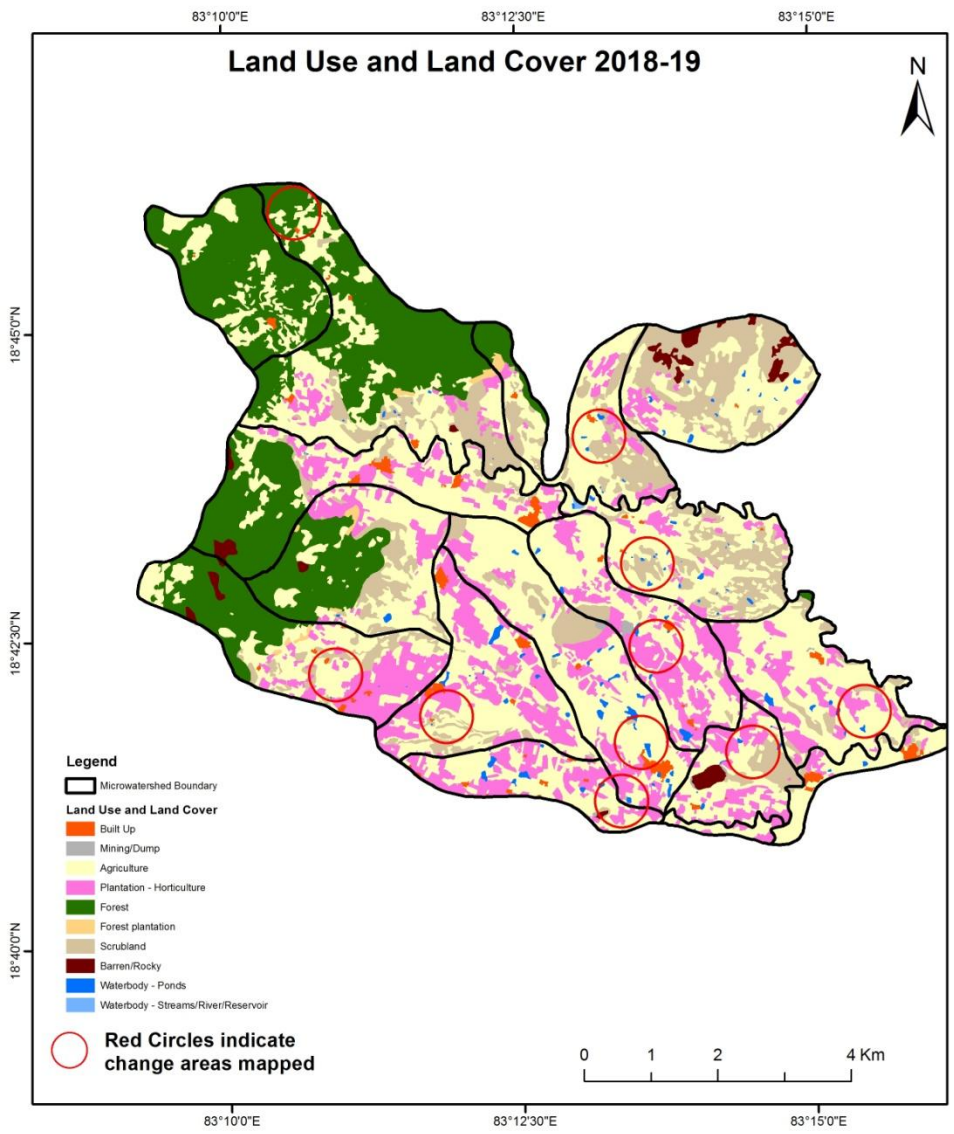


Fig 9. Duggeru Watershed (IWMP-06/2013-14) Comparative assessment of Land Use and Land Cover for Pre and Post IWMP implementation (2018-19 to 2019-20)

Scale: 1:10000



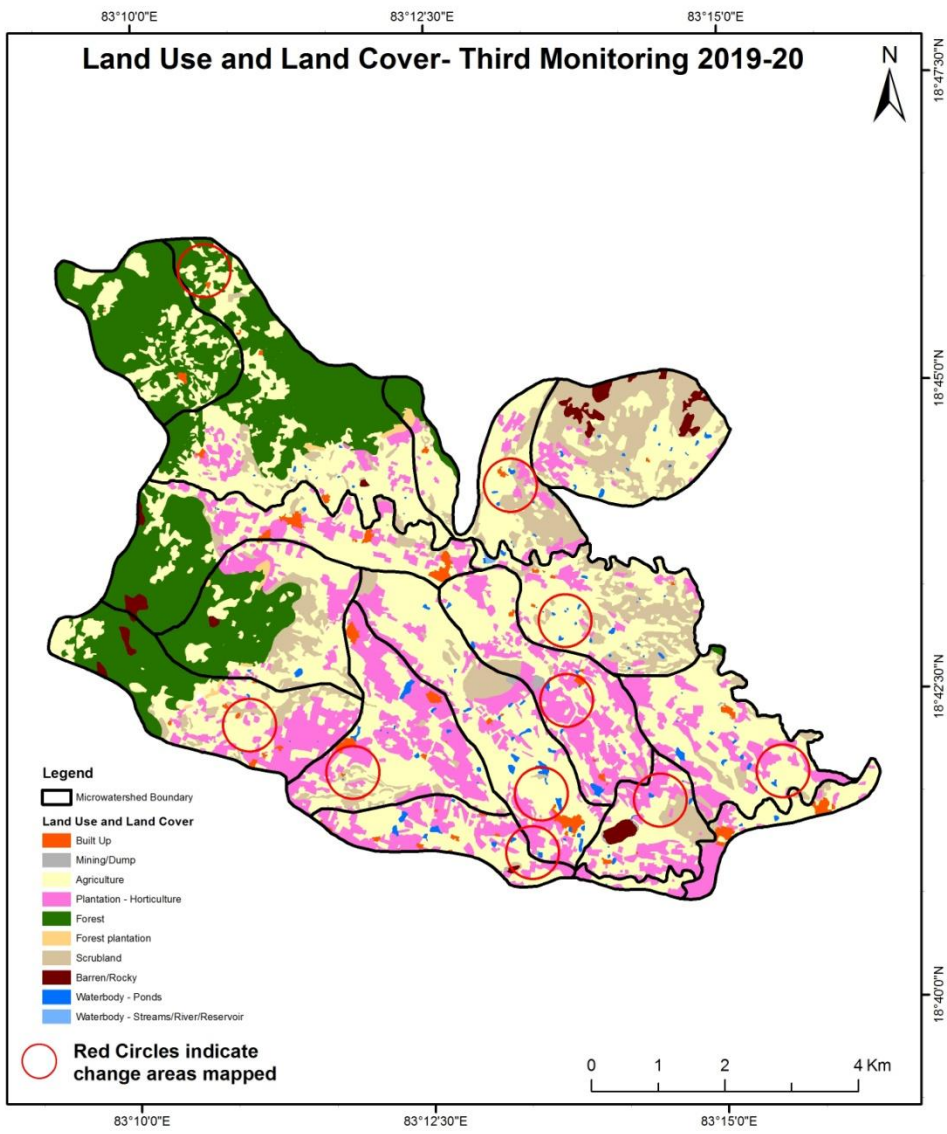
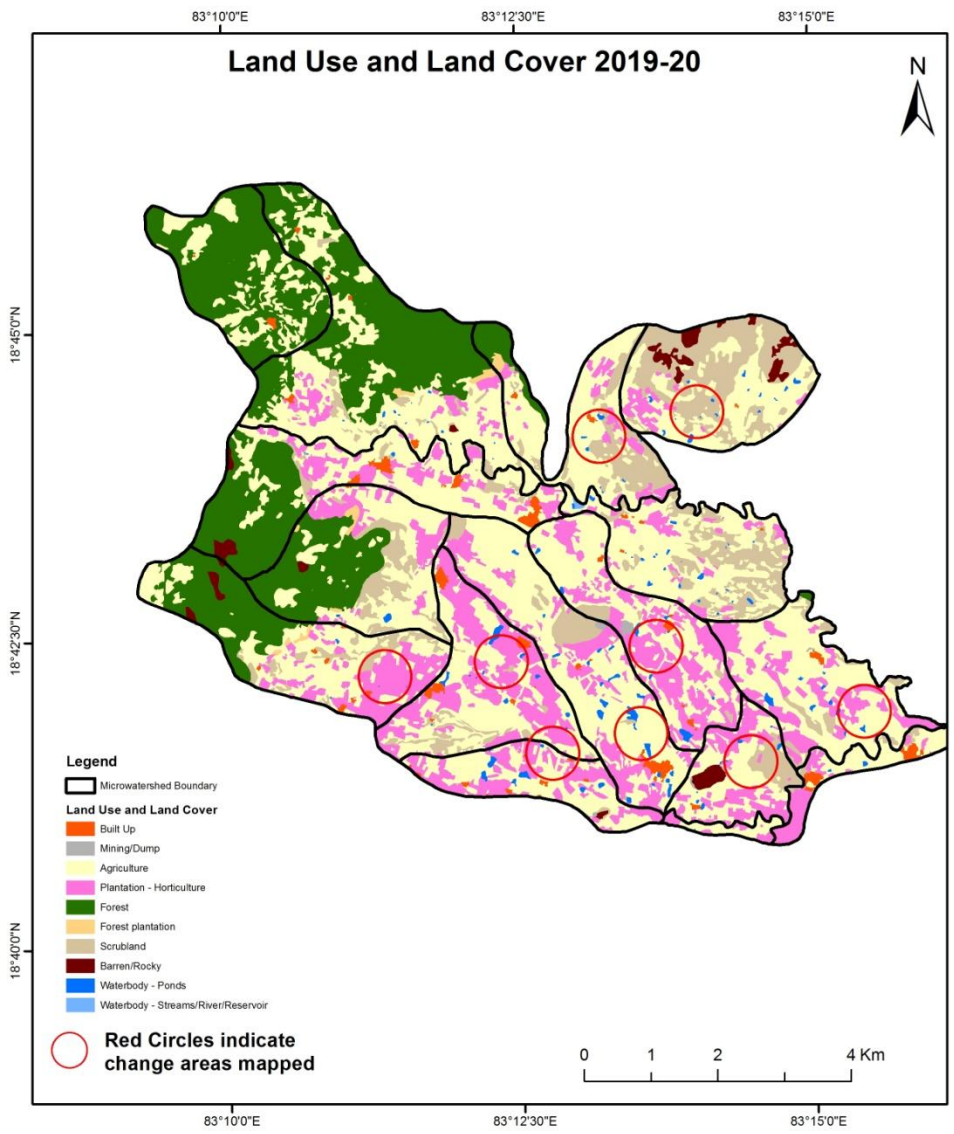


Fig 10. Duggeru Watershed (IWMP-06/2013-14) Comparative assessment of Land Use and Land Cover for Pre and Post IWMP implementation (2019-20 to 2020-21)

Scale: 1:10000



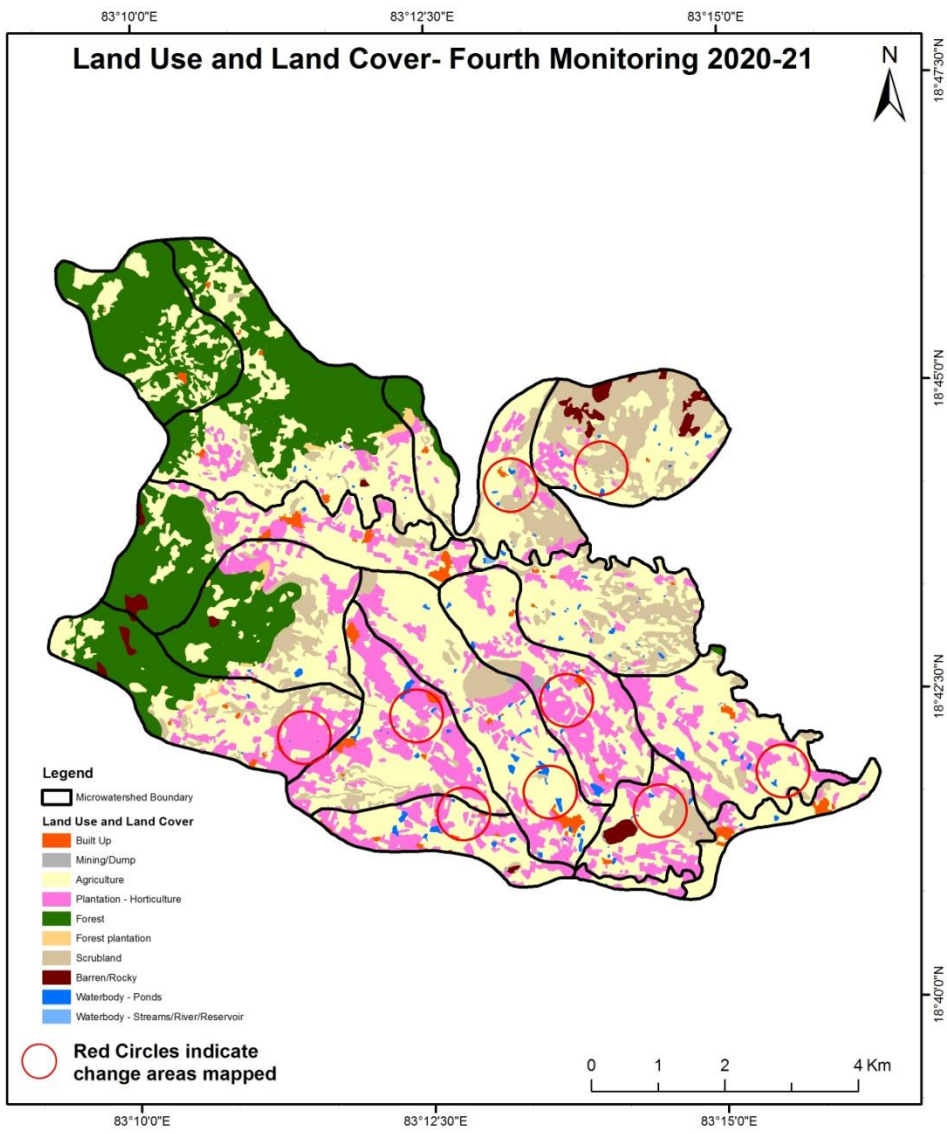
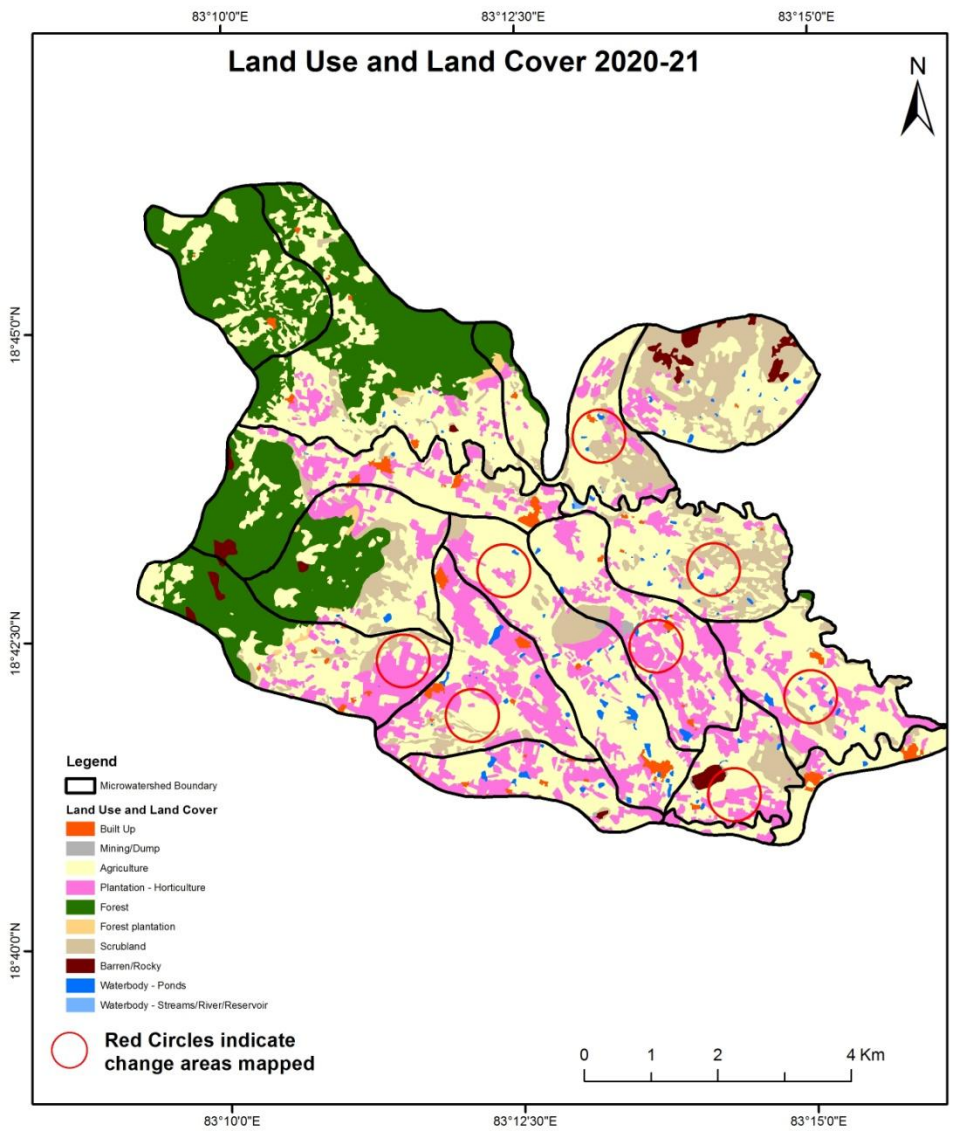


Fig 11. Duggeru Watershed (IWMP-06/2013-14) Comparative assessment of Land Use and Land Cover for Pre and Post IWMP implementation (2020-21 to 2021-22)

Scale: 1:10000



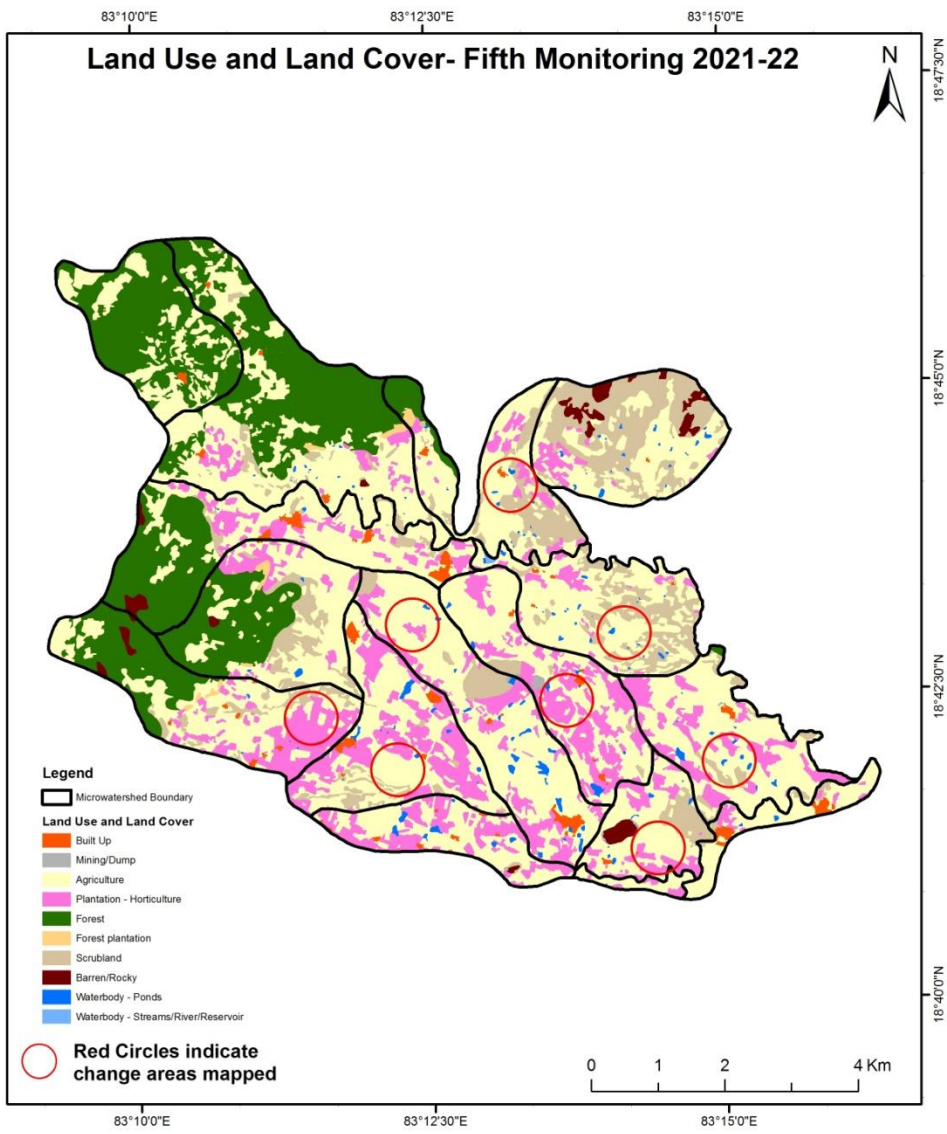
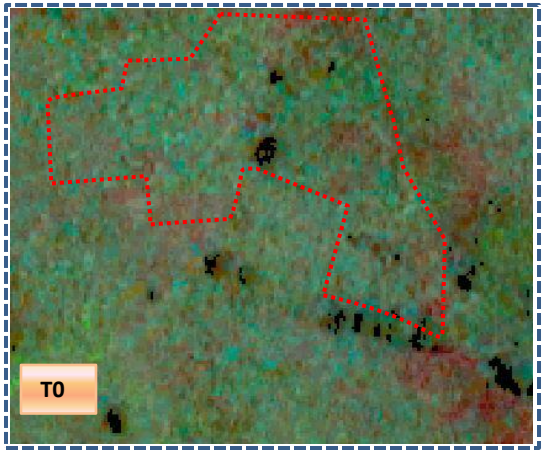
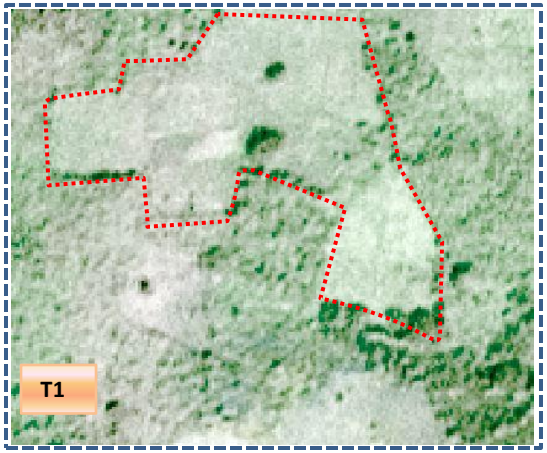


Fig 12. Duggeru Watershed (IWMP-06/2013-14) Land Use and Land Cover changes for Pre and Post treatment dates

Forest to Agriculture

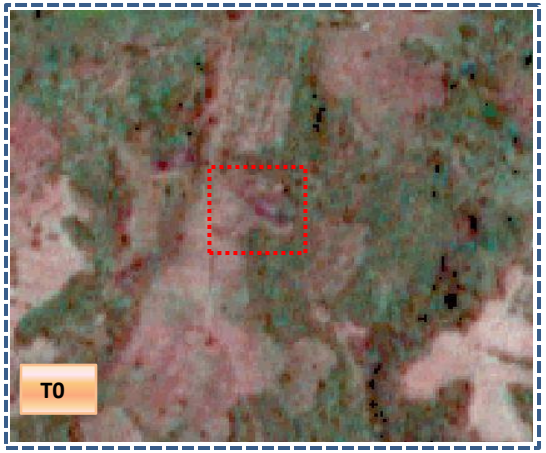


T0: 2013-14 (83°10'27.395"E 18°46'8.435"N)

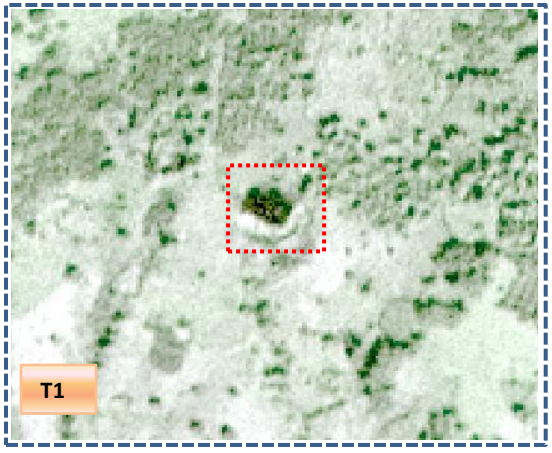


T1: 29 October 2017

Agriculture to water body



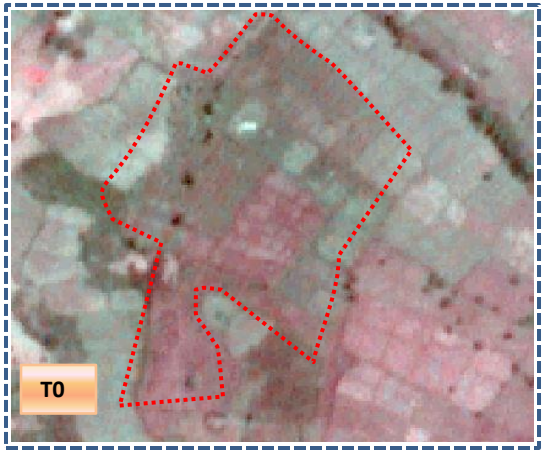
T0: 2013-14 (83°11'45.249"E 18°44'30.229"N)



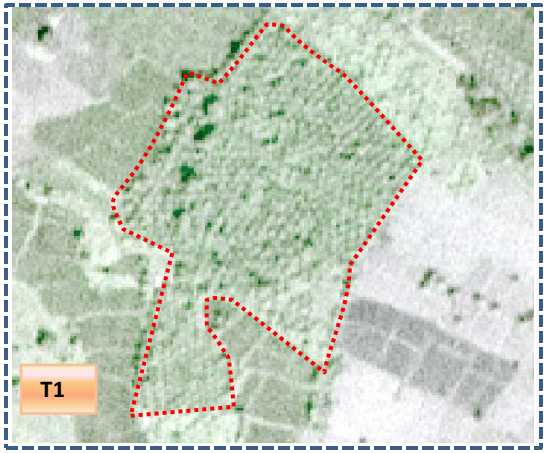
T1: 29 October 2017

Fig 13. Duggeru Watershed (IWMP-06/2013-14) Land Use and Land Cover changes for Pre and Post treatment dates

Agriculture to Plantation

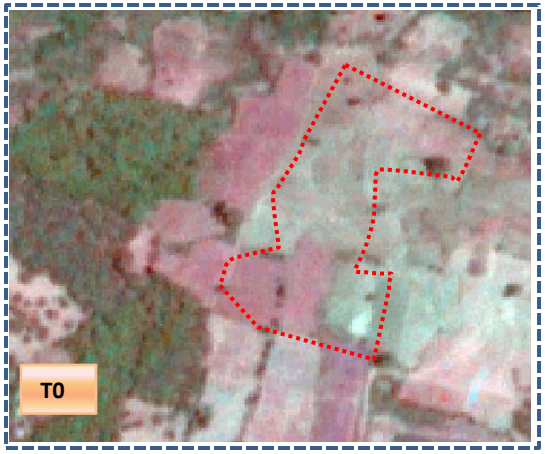


T0: 2013-14 (83°11'59.98"E 18°42'40.211"N)

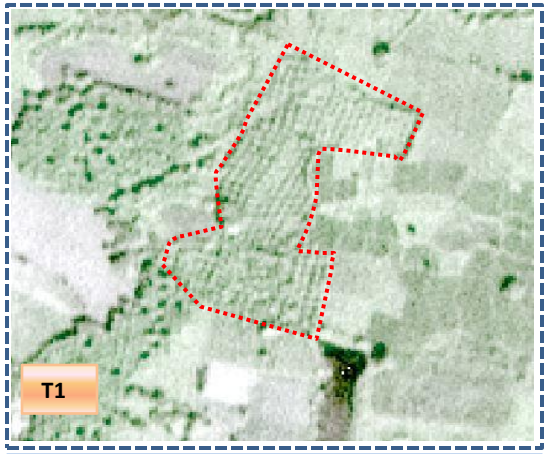


T1: 29 October 2017

Agriculture to Plantation



T0: 2013-14 (83°11'50.596"E 18°42'18.33"N)



T1: 29 October 2017

Table 4. showing change matrix depicting Land cover transitions for Duggeru Watershed (IWMP-06/2013-14) 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	62.02										**62.02**
Mining/dump		7.84									**7.84**
Agriculture	2.73		1802.28	250.98	16.21	2.96		8.09		2.73	**2085.98**
Plantation Horticulture	0.06		70.04	605.99							**676.09**
Forest					1451.06					0.18	**1451.24**
Forest Plantation						15.46					**15.46**
Barren Rocky							68.54				**68.54**
Scrub	0.3		233.92	17.67				1846.2		1.53	**2099.62**
Waterbody-Streams/River									48.57		**48.57**
Waterbody – Ponds			1.46							37.85	**39.31**
Grand Total	**65.11**	**7.84**	**2107.7**	**874.64**	**1467.27**	**18.42**	**68.54**	**1854.29**	**48.57**	**42.29**	**6554.67**

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 283 ha of the agriculture area has decreased and it is converted into Built-up(2.7 ha), plantation/horticulture (250.9 ha) , forest (16 ha), scrub (8 ha) and water body (2.7 ha) in T1.

3. In T1 305 ha of the agriculture area has increased from plantations/horticulture (605 ha) and scrubland (17 ha) of T0.

Table 5. showing change matrix depicting Land cover transitions for Duggeru Watershed (IWMP-06/2013-14) 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	65.11										**65.11**
Mining/dump		7.84									**7.84**
Agriculture	5.17		1801.11	298.6						2.82	**2107.7**
Plantation Horticulture	0.47		27.76	846.3						0.11	**874.64**
Forest			146.11		1318.61	2.55					**1467.27**
Forest Plantation						18.42					**18.42**
Barren Rocky							68.54				**68.54**
Scrub	1.24		947.17	14.55				886.68		4.65	**1854.29**
Waterbody-Streams/River									48.57		**48.57**
Waterbody – Ponds			1.53							40.76	**42.29**
Grand Total	**71.99**	**7.84**	**2923.68**	**1159.45**	**1318.61**	**20.97**	**68.54**	**886.68**	**48.57**	**48.34**	**6554.67**

4. In T1 306 ha of the agriculture area has decreased and it is converted into Built-up(5 ha), plantations/horticulture (298 ha) and water body (2.8 ha) in T2.

5. In T2 1122 ha of the agriculture area has increased from plantations/horticulture (27.7 ha), forest (146 ha),scrubland (947 ha) and water body (1.5 ha) of T1.

Table 6. showing change matrix depicting Land cover transitions for Duggeru Watershed (IWMP-06/2013-14) 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	71.99										**71.99**
Mining/dump		7.84									**7.84**
Agriculture	1.61		2805.59	114.56						1.92	**2923.68**
Plantation Horticulture	0.16		31.54	1127.48						0.27	**1159.45**
Forest			15.1		1303.51						**1318.61**
Forest Plantation						20.97					**20.97**
Barren Rocky							68.54				**68.54**
Scrub			132.16	14.9				739.56		0.06	**886.68**
Waterbody-Streams/River									48.57		**48.57**
Waterbody – Ponds										48.34	**48.34**
Grand Total	**73.76**	**7.84**	**2984.39**	**1256.94**	**1303.51**	**20.97**	**68.54**	**739.56**	**48.57**	**50.59**	**6554.67**

6. In T2 118 ha of the agriculture area has decreased and it is converted into Built-up (1.6 ha), plantations/horticulture (114 ha) and water body (1.9 ha) in T3.

7. In T3 178 ha of the agriculture area has increased from plantations/horticulture (31.5 ha), forest (15 ha) and scrubland (132 ha) of T2.

Table 7. showing change matrix depicting Land cover transitions for Duggeru Watershed (IWMP-06/2013-14) 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	73.76										**73.76**
Mining/dump	0.1	7.74									**7.84**
Agriculture			2972.33	12.06							**2984.39**
Plantation Horticulture			84.82	1172.12							**1256.94**
Forest					1303.51						**1303.51**
Forest Plantation						20.97					**20.97**
Barren Rocky							68.54				**68.54**
Scrub								739.56			**739.56**
Waterbody-Streams/River									48.57		**48.57**
Waterbody – Ponds										50.59	**50.59**
Grand Total	**73.86**	**7.74**	**3057.15**	**1184.18**	**1303.51**	**20.97**	**68.54**	**739.56**	**48.57**	**50.59**	**6554.67**

8.In T3 12 ha of the agriculture area has decreased and it is converted into plantations/horticulture (12 ha) in T4.

9. In T4 84 ha of the agriculture area has increased from plantations/horticulture (84 ha) of T3.

Table 8. showing change matrix depicting Land cover transitions for Duggeru Watershed (IWMP-06/2013-14) 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	73.86										**73.86**
Mining/dump		6.78								0.96	**7.74**
Agriculture	0.84		3053.37		1.56					1.38	**3057.15**
Plantation Horticulture			130.01	1053.87						0.3	**1184.18**
Forest			64.88		1238.63						**1303.51**
Forest Plantation						19.92					**19.92**
Barren Rocky							68.54				**68.54**
Scrub			17.79					721.25		0.52	**739.56**
Waterbody-Streams/River									48.57		**48.57**
Waterbody – Ponds			0.29							50.3	**50.59**
Grand Total	**74.7**	**6.78**	**3266.34**	**1053.87**	**1240.19**	**19.92**	**68.54**	**721.25**	**48.57**	**53.46**	**6554.67**

10. In T4 3.7 ha of the agriculture area has decreased and it is converted into built-up (0.8 ha), forest (1.5 ha) and plantations (1.3 ha)in T5.

11. In T5 213 ha of the agriculture area has increased from plantations/horticulture (130 ha), forest (64.8 ha) scrubland (17.7 ha) and water body (0.29 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 14.15 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 21, 815, 60, 72 & 209 Hectares from T0-T1, T1-T2, T2-T3, T3-T4 & T4-T5 respectively and overall increase of 1,180 Hectares in Crop land area as compared between baseline Land Use/Land Cover data 2013-14 (T0) & 2021-22 (T5) years.
4. About **377 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 1,378 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