MONITORING OF IWMP WATERSHED PROJECTS USING GEO-INFORMATION

SUMMARY REPORT

IWMP-Batch-IV

YSR KADAPA -40/2012-13
Andhra Pradesh

Submitted to NRSC, Balanagar, Hyderabad
December-2022

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

AGRICULTURE & SOIL DIVISION
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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
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EXECUTIVE SUMMARY

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-40/2012-13, YSR Kadapa District of Andhra Pradesh. The total geographical area of the project is **5,584** ha. It comprises of 12 micro watersheds.
4. In the project area 140 Drishti photos were uploaded showing check dams/Rock fill dam, livelihood activities, and remaining showing other activities.
5. Water bodies have shown an increase by 24 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. 46% is covered by the agriculture, 21 forest area, 12 % is horticulture, 10 % is covered by scrubland, and remaining by other land use classes.

STUDY AREA
PROJECT : CHINNAMANDEM WATERSHED - IWMP-40/2012-13
DISTRICT : YSR KADAPA , STATE : ANDHRA PRADESH

- The study area falls in Chinnamandem Mandal of YSR Kadapa district of Andhra Pradesh state. The total geographical area of the project is **5,584** ha. It comprises of 12 micro watersheds. Location Map of the study area is shown in Figure 1. Analysis is done for 2012-13 (T0) period (***Batch -1***) projects taking 2020-21 (T5) period satellite images, seen in Table 1 & 2,Fig 04.

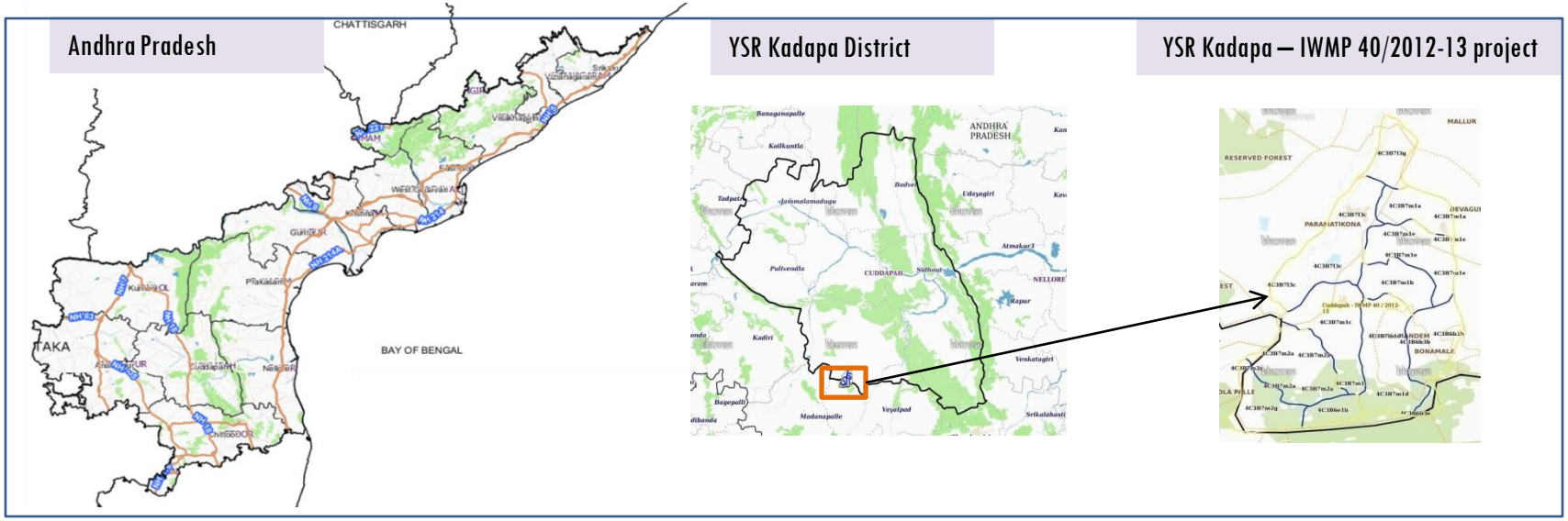


Fig.1. Location map of Chinnamandem Watershed (IWMP-40/2012-13) in YSR Kadapa District, A.P

- YSR Kadapa has a semi-arid climate, with hot and dry conditions for most of the year. Summers start in late February and peak in May with average high temperatures around the 38 °C range and it reaches around 44 °C to 45 °C .
- The average annual rainfall of the YSR Kadapa District is 710 mm, which ranges from nil rainfall in January to 137 mm in October. October is the wettest month of the year. The mean seasonal rainfall distribution is 402.4 mm in southwest monsoon (June - September), 239.1 mm in northeast monsoon (October – December), distribution of rainfall in season wise 56.7 % in south west monsoon, 33.7 % in north east monsoon period.

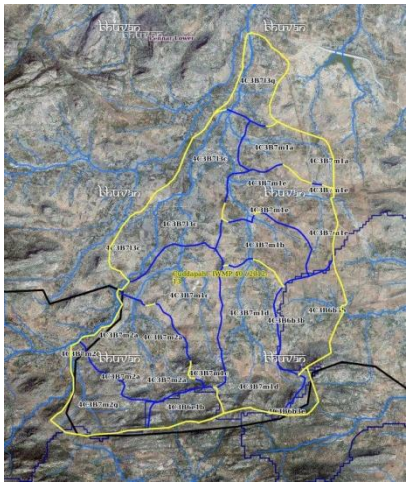
Table 1. Satellite Data and Ancillary Data

Satellite data*	T0-A**	T0-B**	T5
	2012-13	2011-12	2020-21
LISS IV	2012-13		
SCENE 1			19-Mar-21
SCENE2			
SCENE 3			
SCENE 4			
CARTO	2012-13		
SCENE 1			19-Mar-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	140
4	Detailed Project Report		

Fig 1. Natural Color Composite overlaid with Project boundaries and high detail stream network



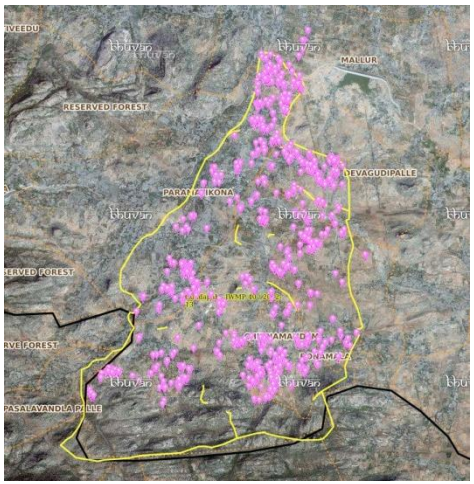
Legend

Drainage (1:10000 Scale)

MWS Boundary

Project Boundary

Fig 2. 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/Horticulture	143	143
2	Afforestation	0	0
3	Black planting	0	0
4	Bund Planting/Horticulture	0	0
5	Trench	0	0
6	Field Bunds	0	0
7	Terrace	0	0
8	Checks & Plugs	0	0
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	0	0
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	Soil moisture conservation	0	0
16	Water harvesting structures (recharge pits and check dams)	0	0
17	Entry Point Activity	0	0
18	Others	0	0
	TOTAL	**143**	**140**

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.Chinnamandem Watershed (IWMP-40/2012-13) Natural Colour Composite (NCC)

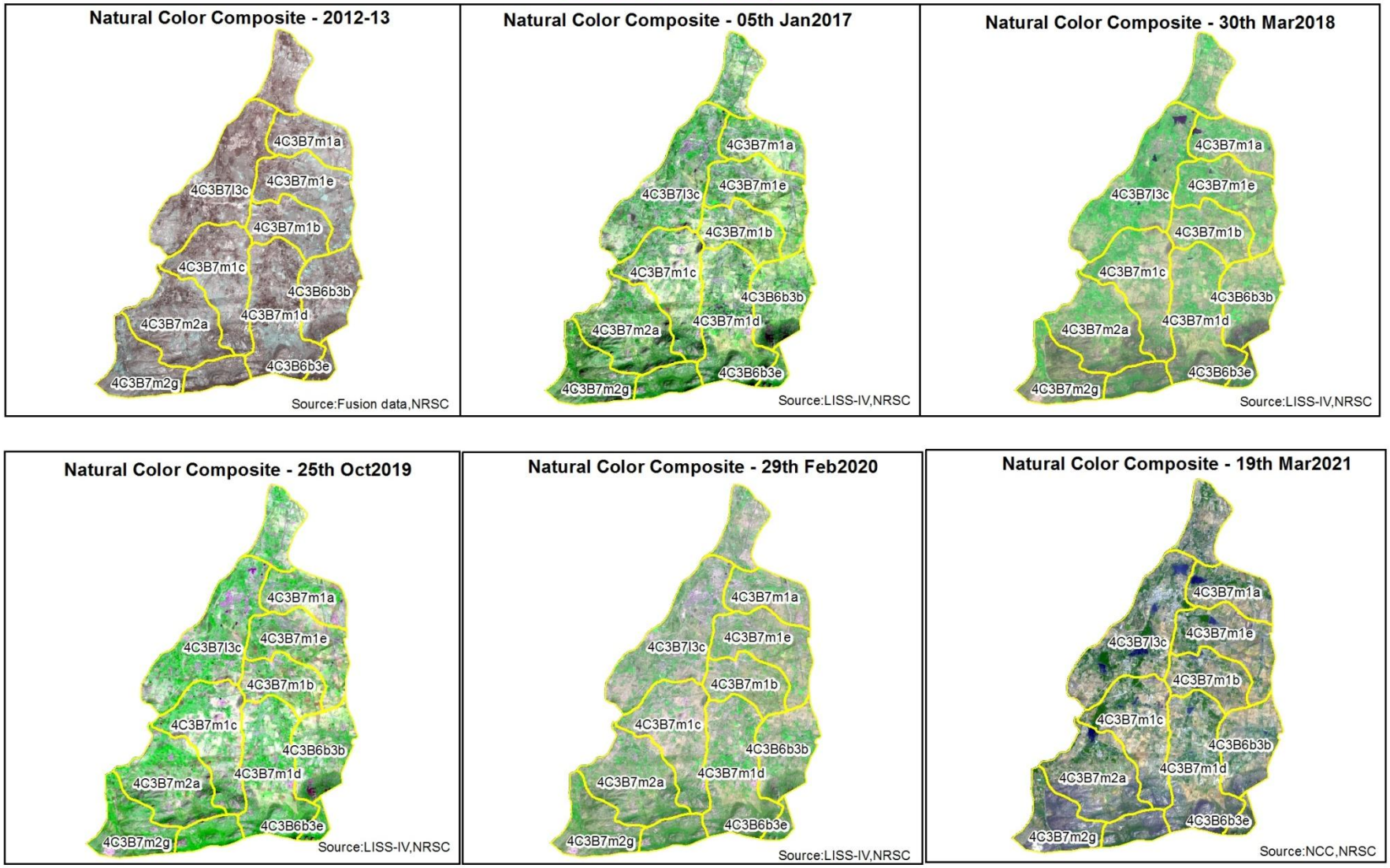


Fig 5. Monitoring of activities in Chinnamandem Watershed (IWMP-40/2012-13) YSR Kadapa District Andhra Pradesh

T0 Satellite data 2013

T1 Satellite data 2017

T2 Satellite data 2018

T3 Satellite data 2019

T4 Satellite data 2020

T5 Satellite data 2021

Drishti Id. 87020

DLH mango

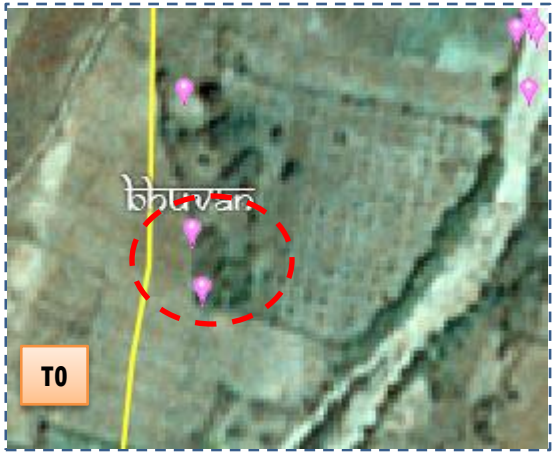
Fig 6. Monitoring of activities in Chinnamandem Watershed (IWMP-40/2012-13) YSR Kadapa District Andhra Pradesh

T0: 2012-13

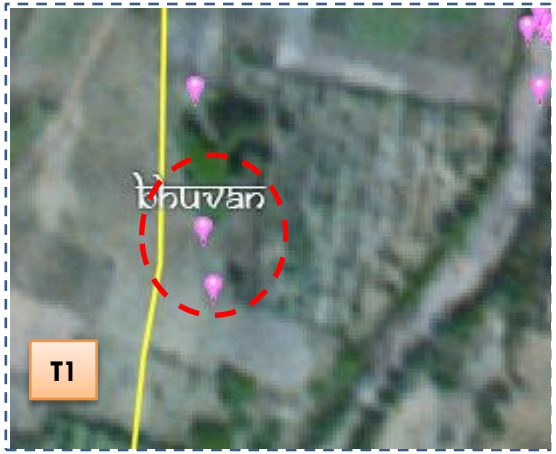
T1: 05 january 17

Drishti Sl no. 1439124 MWS : 4C3B7l3c

Check Dam



T0: 2012-13



T1: 05 january 17

Drishti Sl no. 789822 MWS : 4C3B7l3g

Horticulture

Fig 7. Monitoring of activities in Chinnamandem Watershed (IWMP-40/2012-13) YSR Kadapa District Andhra Pradesh

T0: 2012-13

T1: 05 January 17

Drishti Sl no. 892600 MWS : 4C3B7m1b

Horticulture

T0: 2012-13

T1: 05 January 17

Drishti Sl no. 2460497 MWS : 4C3B7m1b

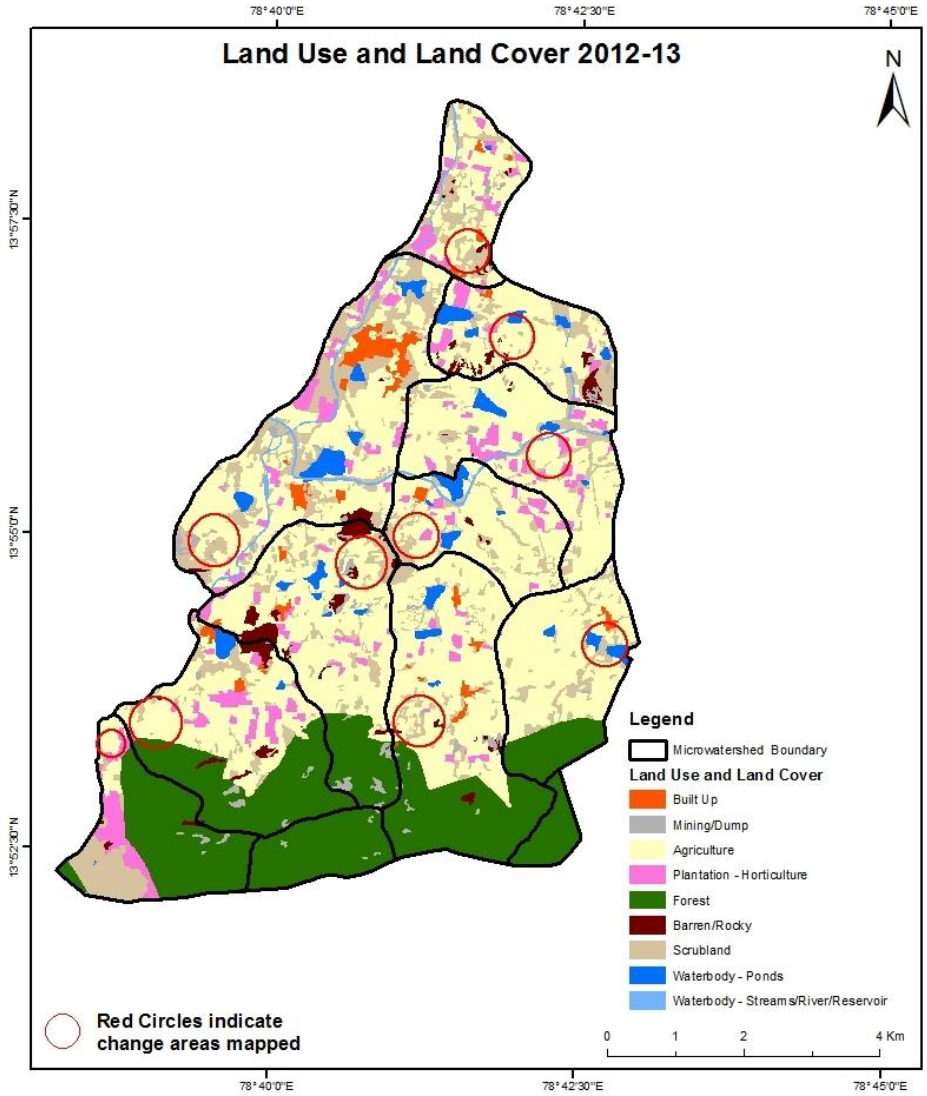
Horticulture

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. Chinnamandem Watershed (IWMP-40/2012-13) Comparative assessment of Land Use and Land Cover for Pre and Post IWMP implementation (2012-13 to 2016-17)

Scale: 1:10000



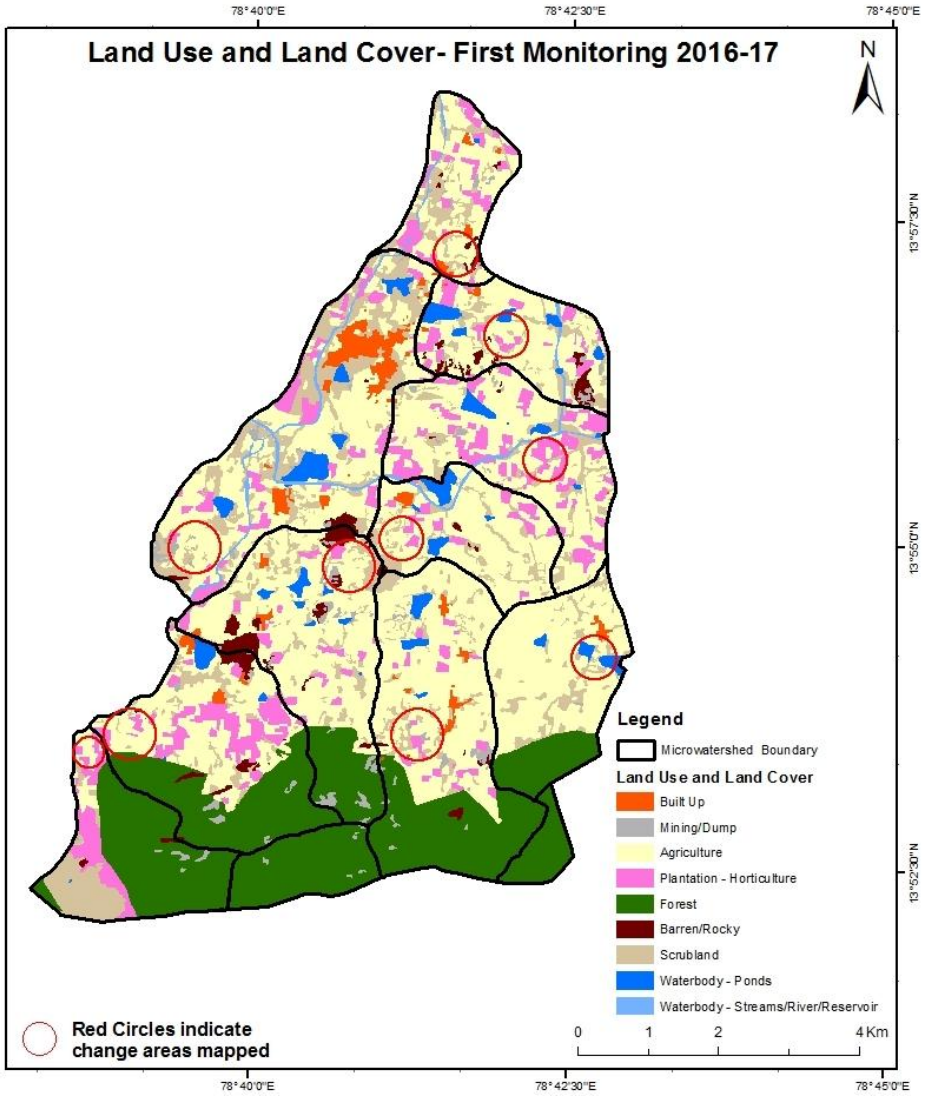
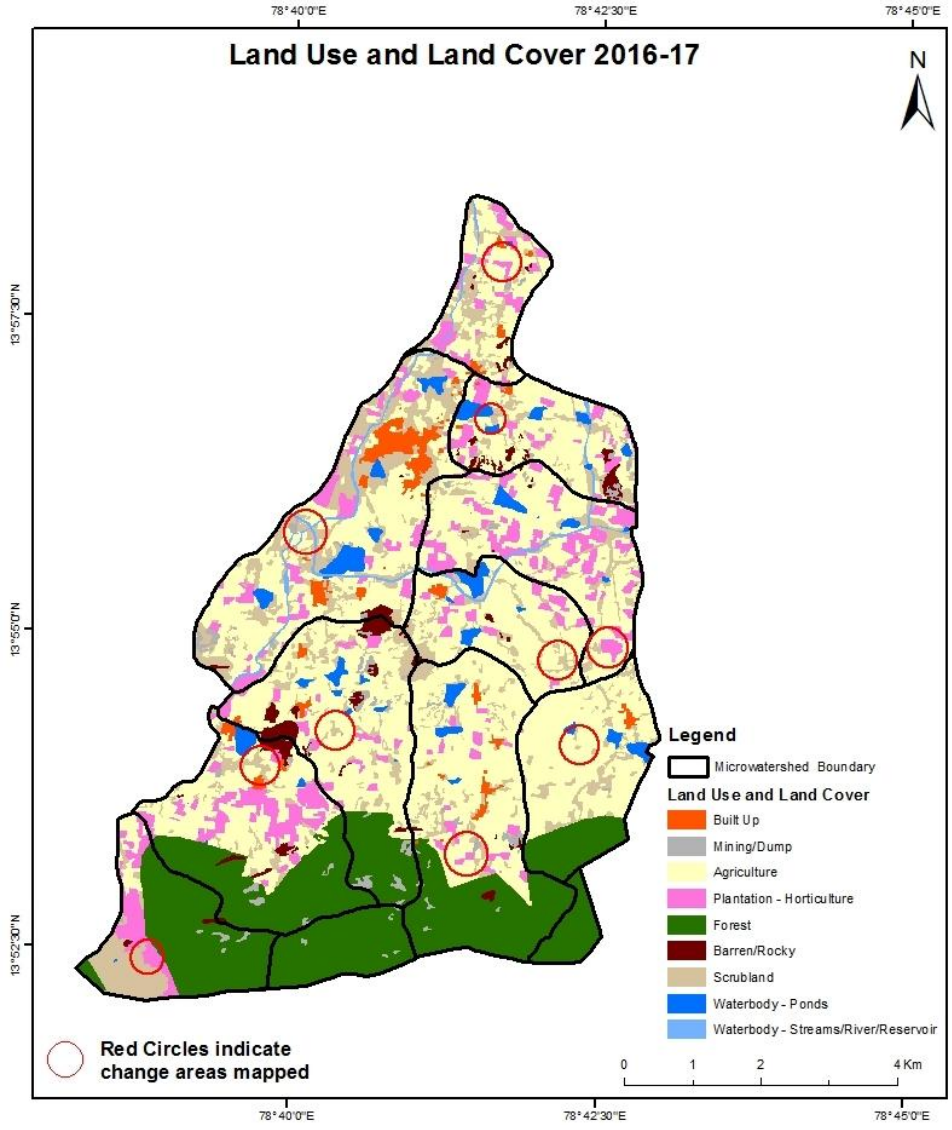


Fig 8. Chinnamandem Watershed (IWMP-40/2012-13) Comparative assessment of Land Use and Land Cover for Pre and Post IWMP implementation (2016-17 to 2017-18)

Scale: 1:10000



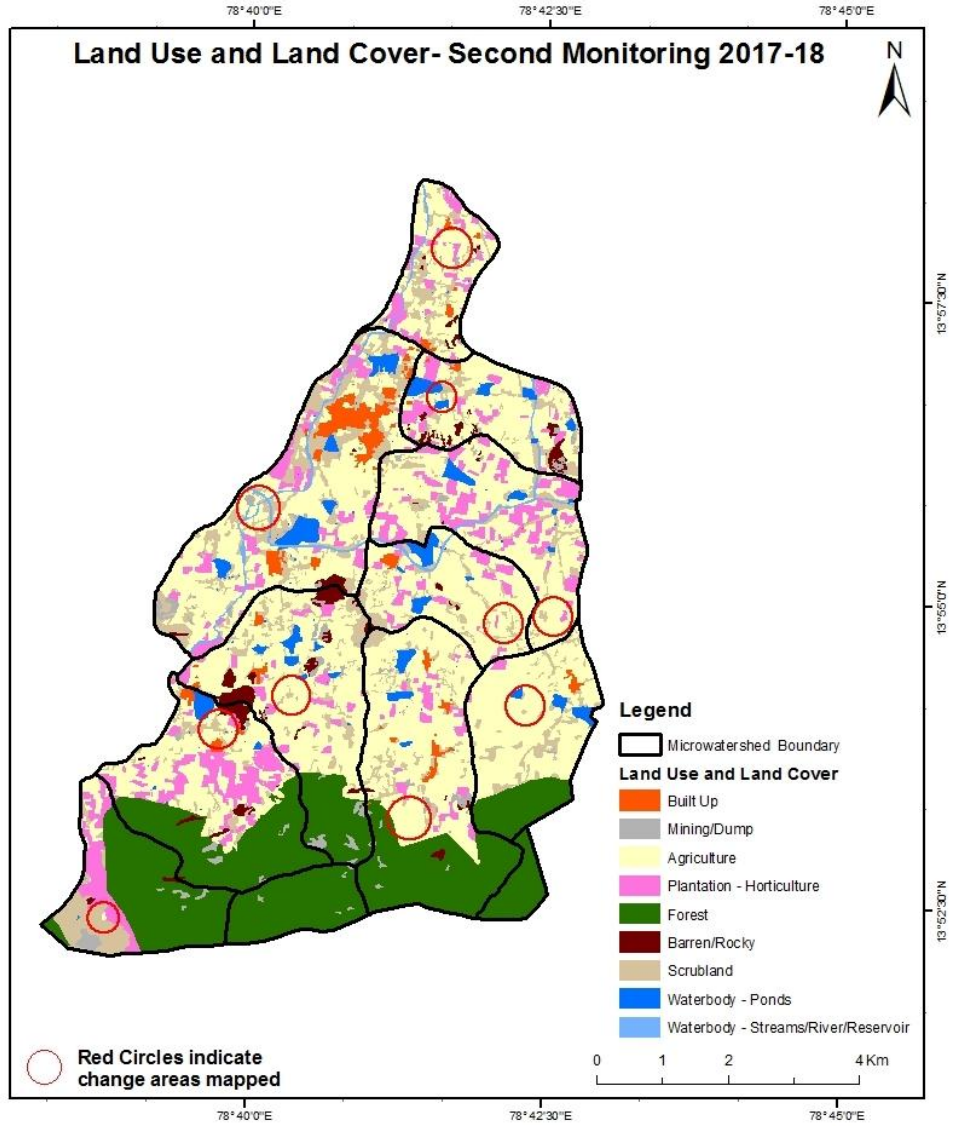
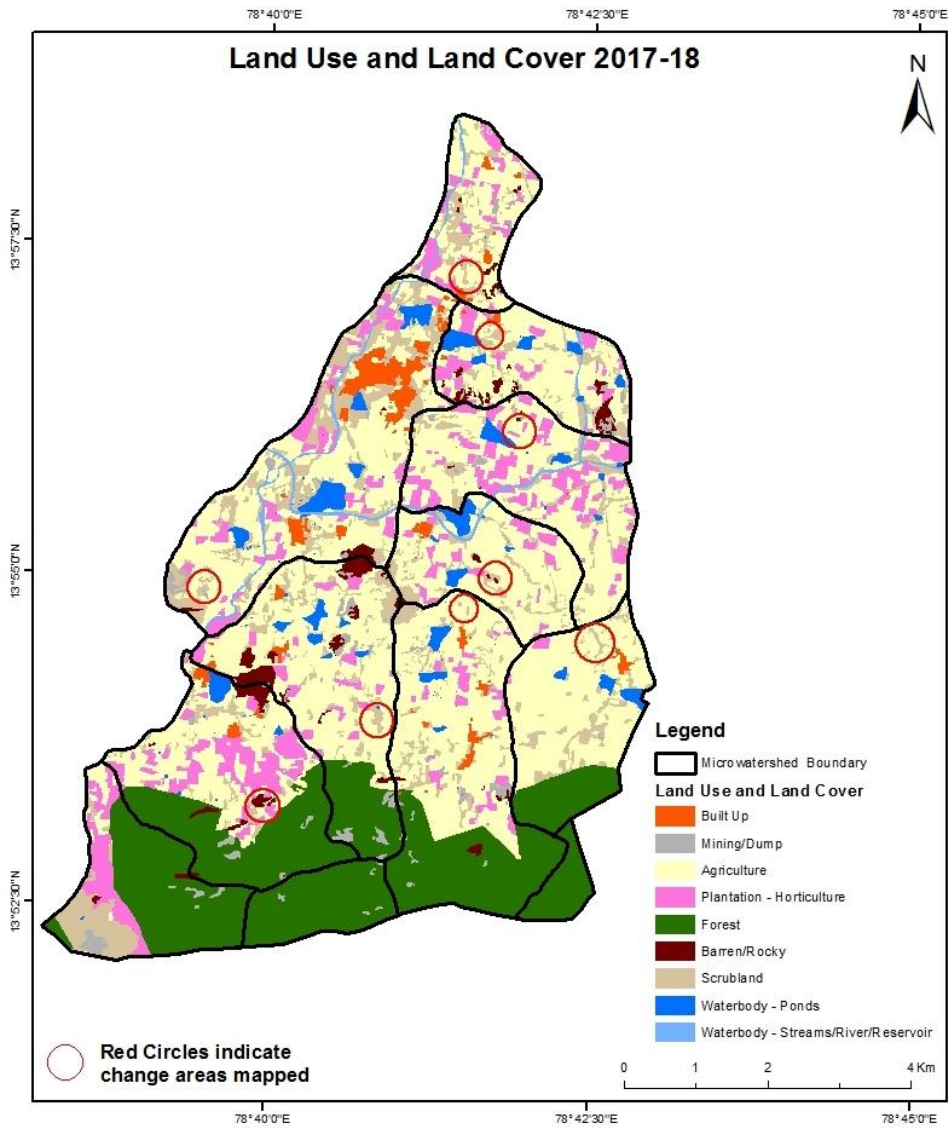


Fig 9. Chinnamandem Watershed (IWMP-40/2012-13) Comparative assessment of Land Use and Land Cover for Pre and Post IWMP implementation (2017-18 to 2018-19)

Scale: 1:10000



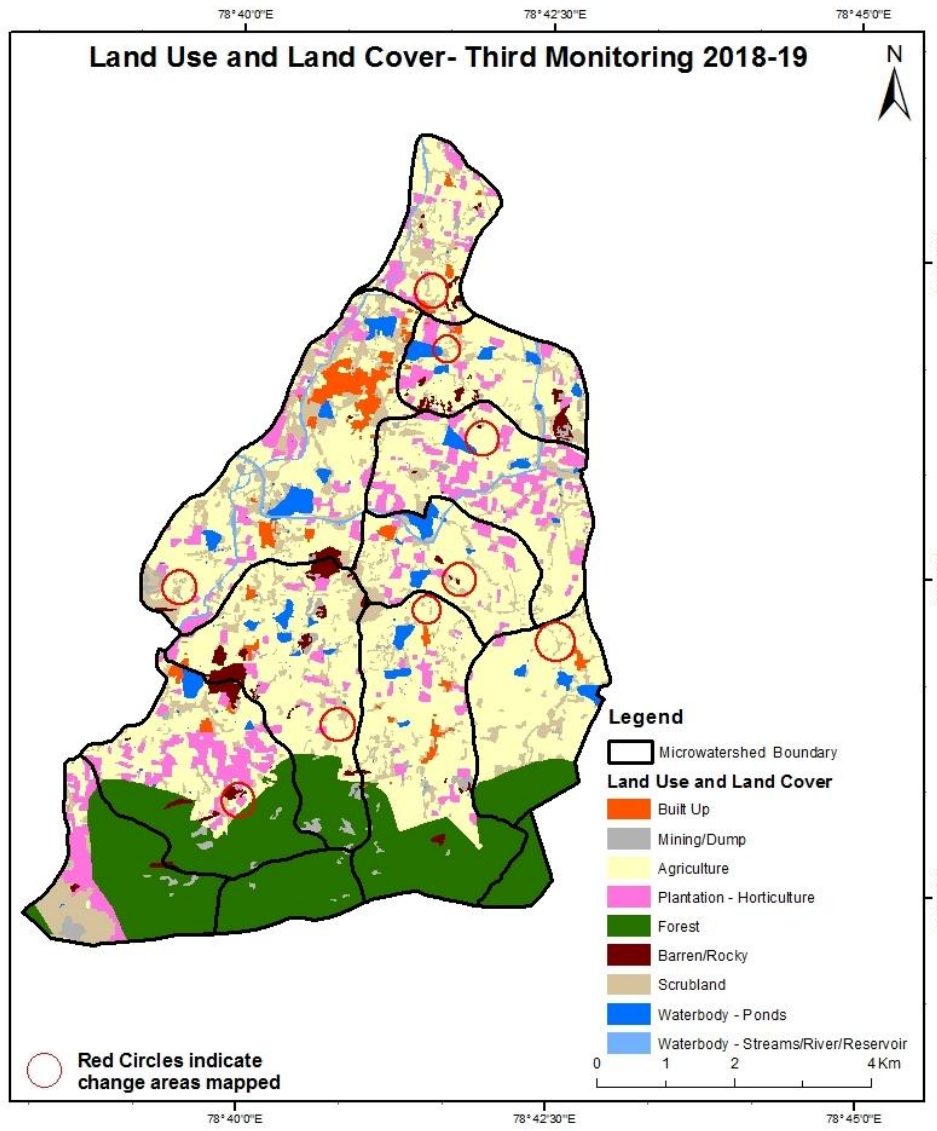
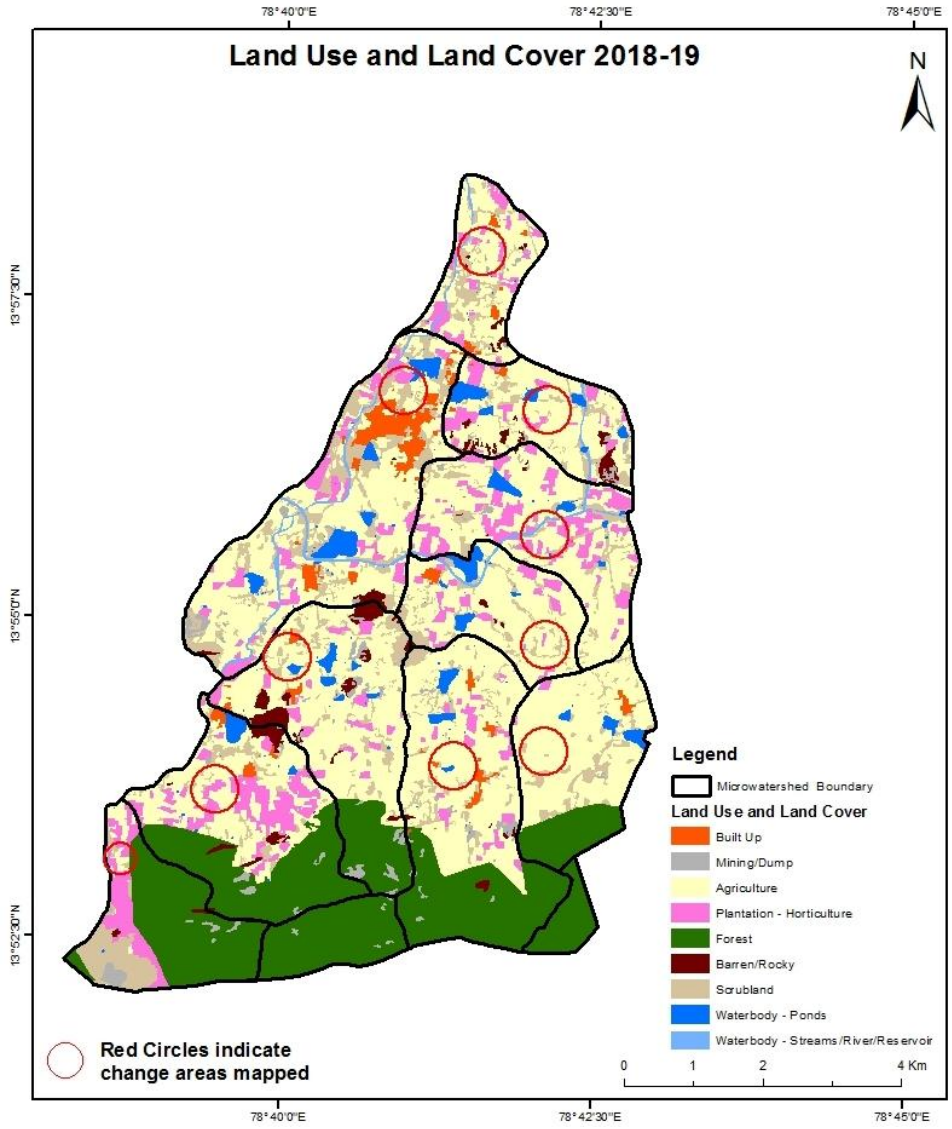


Fig 10. Chinnamandem Watershed (IWMP-40/2012-13) Comparative assessment of Land Use and Land Cover for Pre and Post IWMP implementation (2018-19 to 2019-20)

Scale: 1:10000



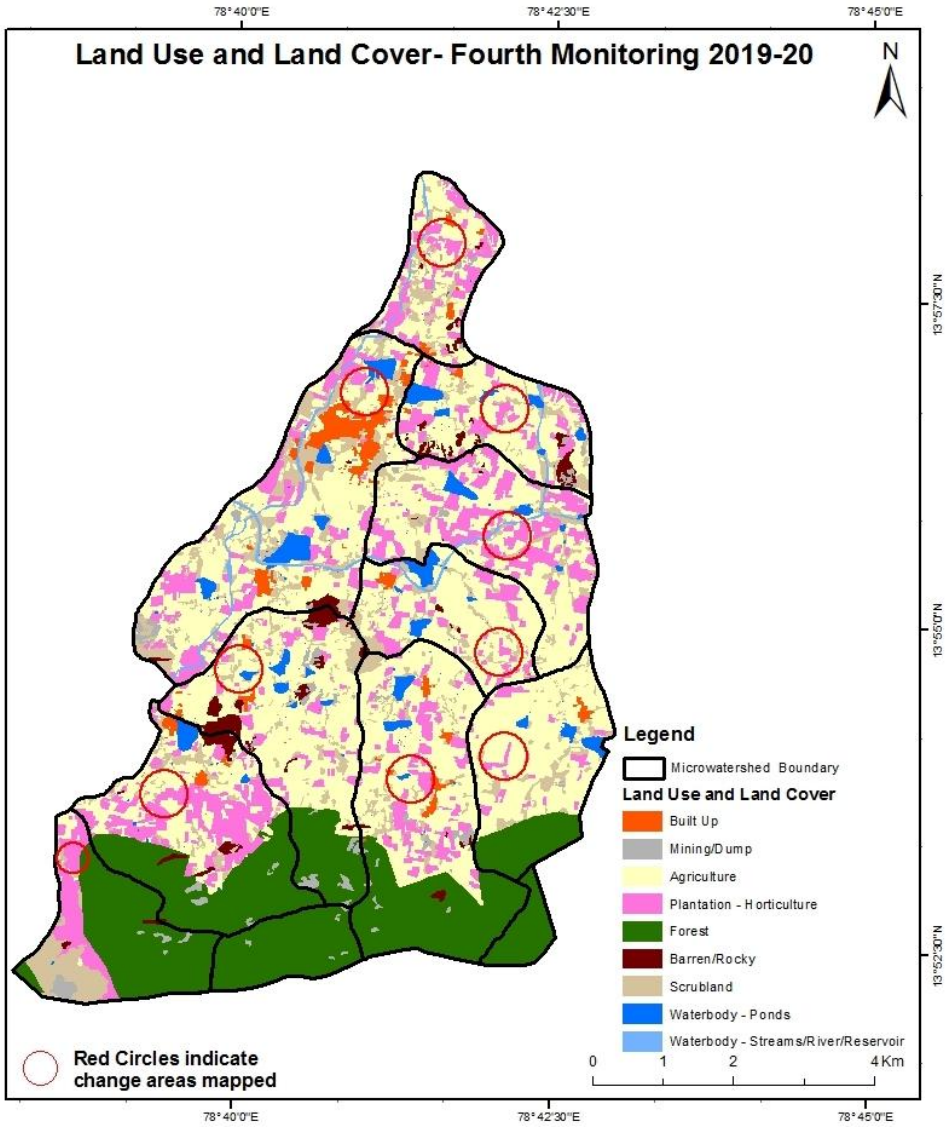
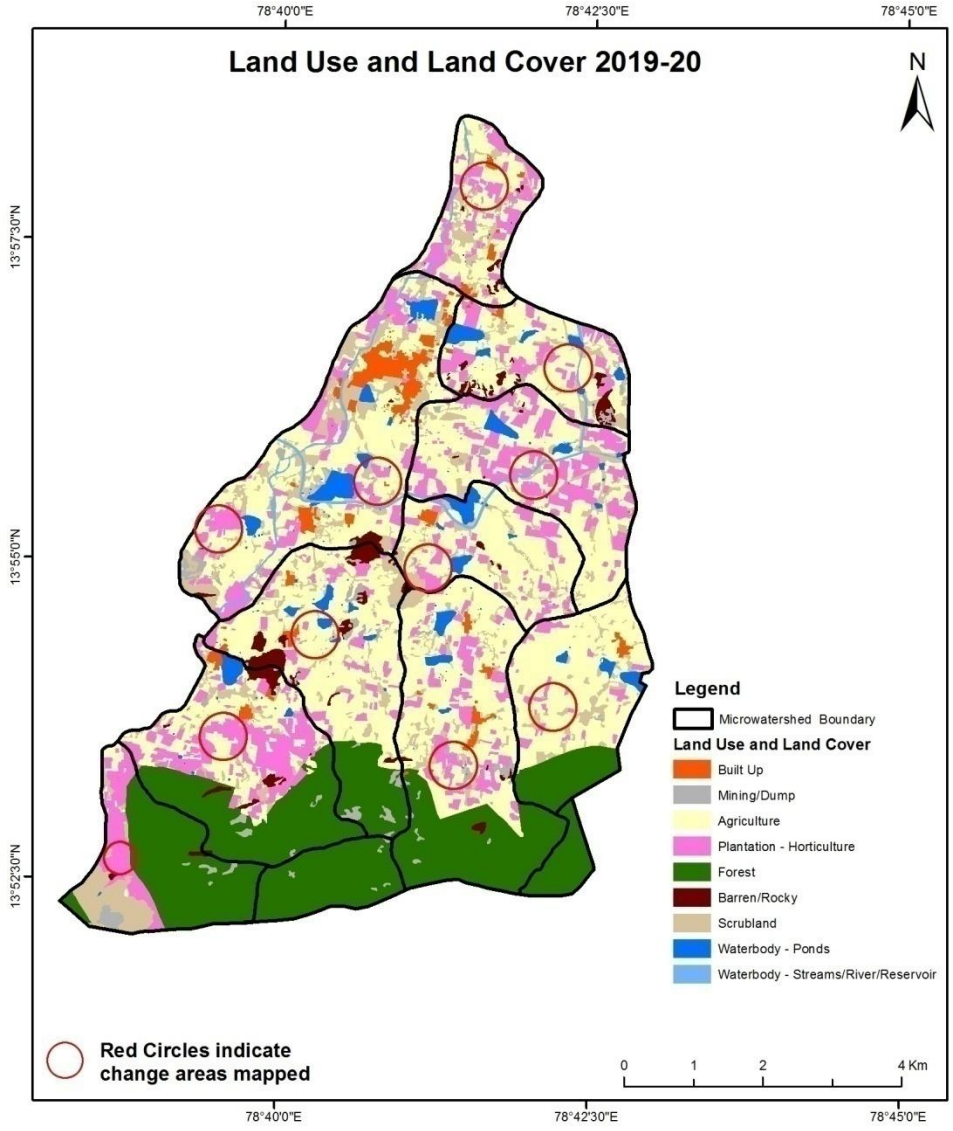


Fig 11. Chinnamandem Watershed (IWMP-40/2012-13) Comparative assessment of Land Use and Land Cover for Pre and Post IWMP implementation (2019-20 to 2020-21)

Scale: 1:10000



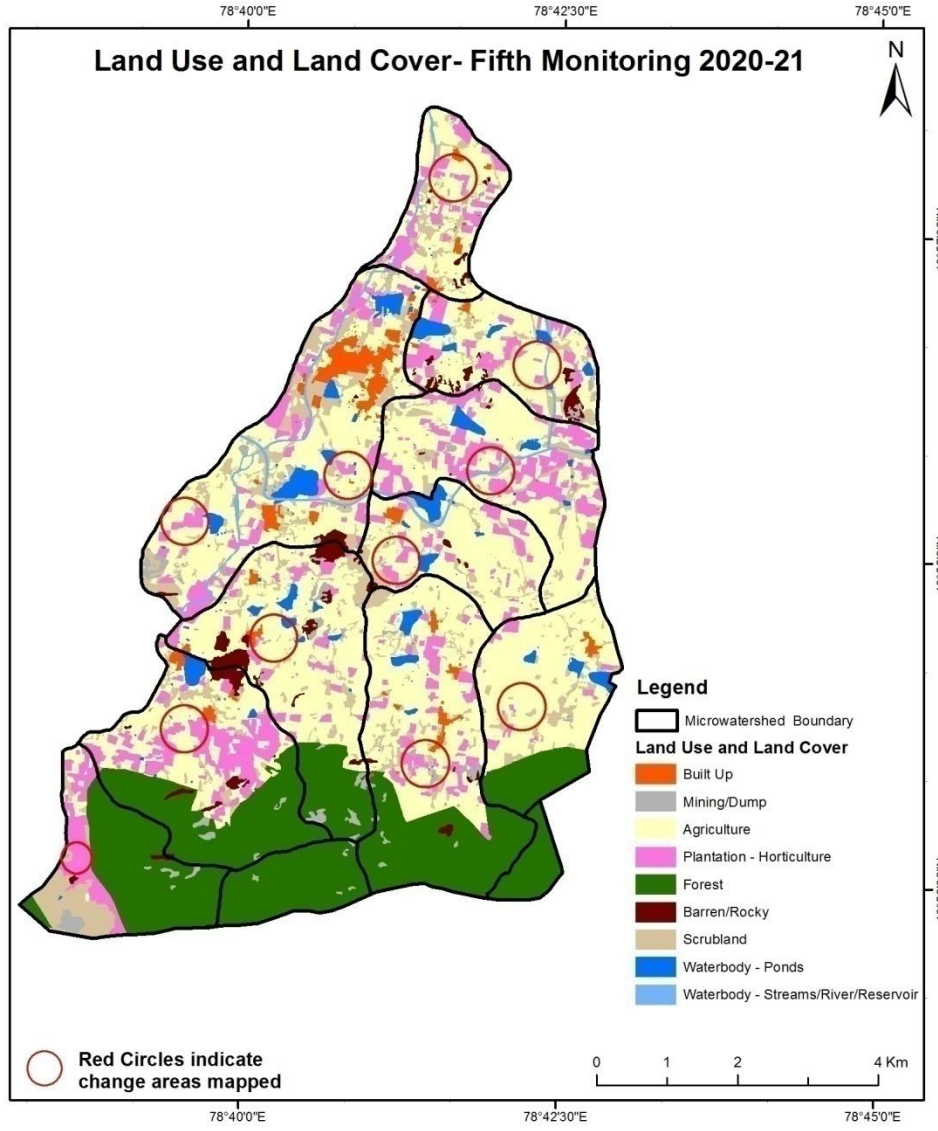
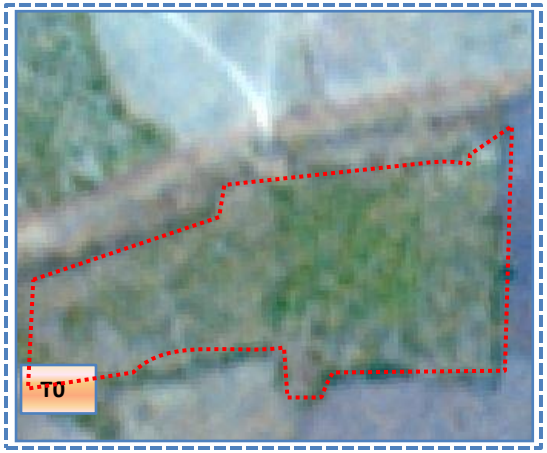


Fig 12. Chinnamandem Watershed (IWMP-40/2012-13) Land Use and Land Cover changes for Pre and Post treatment dates

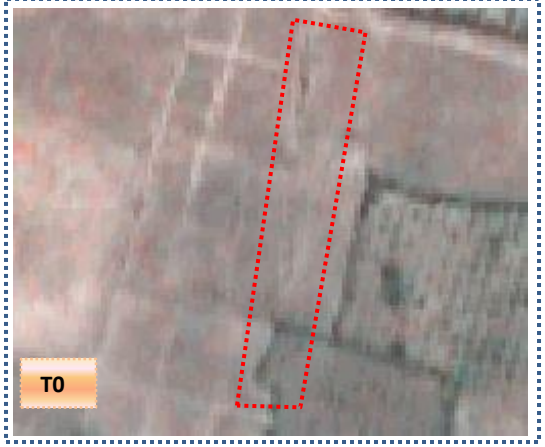
Agriculture to Plantation

T0: 2012-213 (78°40'19.167"E 13°53'46.252"N)



T0: 05 January 17

Agriculture to Canal



T0: 2012-13 (79°1'19.884"E 14°57'48.047"N)

T0: 05 January 17

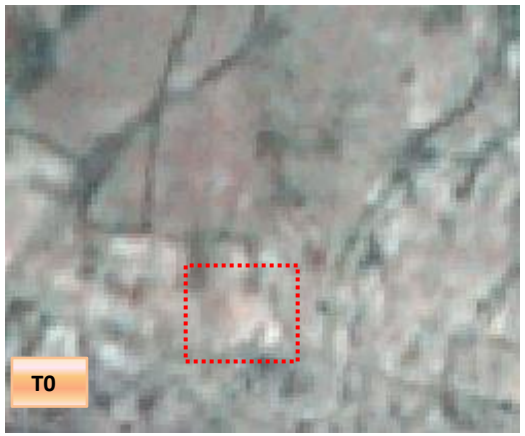
Fig 13. Chinnamandem Watershed (IWMP-40/2012-13) Land Use and Land Cover changes for Pre and Post treatment dates

Scrub to Agriculture

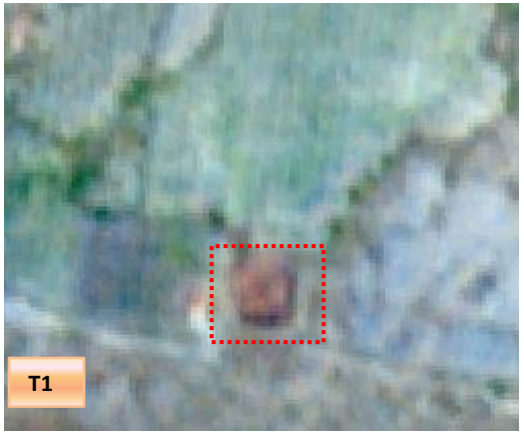
T0: 2012-13 (78°39'47.135"E 13°53'57.573"N)

T1: 05 January 17

Scrub To Water body



T0: 2012-13 (78°39'19.576"E 13°53'19.307"N)



T1: 05 January 17

Table 4. showing change matrix depicting Land cover transitions for Chinnamandem Watershed (IWMP-40/2012-13) during study period-2012-13 to 2016-17

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	98.75										**98.75**
Mining/dump		75.50									**75.50**
Agriculture	14.43	0.07	2577.01	203.27				4.09	1.29	0.37	**2800.52**
Plantation Horticulture	0.22		2.32	328.82							**331.36**
Forest			3.56		1175.10						**1178.67**
Forest Plantation											
Barren Rocky		3.09					99.28				**102.37**
Scrub	0.28	0.72	51.57	1.15				737.92	1.85	0.33	**793.81**
Waterbody-Streams/River									56.69		**56.69**
Waterbody – Ponds										146.68	**146.68**
Grand Total	**113.68**	**79.37**	**2634.46**	**533.23**	**1175.10**		**99.28**	**742.01**	**59.83**	**147.38**	**5584.35**

The example of "Agriculture" Land cover for the period 2012-13 to 2020-21

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

2. In T0 223 ha of the agriculture area has decreased and it is converted into Built-up (14 ha), mining/dump(0.07 ha) plantation /horticulture (203 ha), scrubland (4 ha) and water body (1.66 ha) in T1.

3.In T1 57 ha of the agriculture area has increased from plantations /horticulture (2.3 ha), forest (3.5 ha) and scrubland (51 ha)of T2.

Table 5. showing change matrix depicting Land cover transitions for Chinnamandem Watershed (IWMP-40/2012-13) during study period-2016-17 to 2017-18

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	113.68										**113.68**
Mining/dump		79.35								0.03	**79.37**
Agriculture	6.25		2539.58	82.67						5.96	**2634.46**
Plantation Horticulture			41.29	491.72						0.22	**533.23**
Forest			0.57		1174.44					0.09	**1175.10**
Forest Plantation											
Barren Rocky							99.28				**99.28**
Scrub	0.09	8.53	67.91	3.30				657.89		4.31	**742.01**
Waterbody-Streams/River									59.83		**59.83**
Waterbody – Ponds			1.23							146.14	**147.38**
Grand Total	**120.02**	**87.87**	**2650.58**	**577.69**	**1174.44**		**99.28**	**657.89**	**59.83**	**156.76**	**5584.35**

4. In T1 94 ha of the agriculture area has decreased and it is converted into Built-up (6.2 ha), plantations/horticulture (82 ha) and water body (5.9 ha) in T2.

5. In T2 111 ha of the agriculture area has increased from plantations/horticulture (41 ha), forest (0.5 ha), scrubland (67 ha) and water body (1.2 ha) of T1.

Table 6. showing change matrix depicting Land cover transitions for Chinnamandem Watershed (IWMP-40/2012-13) during study period-2017-18 to 2018-19

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	120.02										**120.02**
Mining/dump		87.87									**87.87**
Agriculture		0.16	2649.51	0.10						0.81	**2650.58**
Plantation Horticulture			24.54	553.12						0.02	**577.69**
Forest					1174.44						**1174.44**
Forest Plantation											
Barren Rocky							99.28				**99.28**
Scrub	0.10	1.48	37.63					618.06		0.62	**657.89**
Waterbody-Streams/River									59.83		**59.83**
Waterbody – Ponds			0.37							156.39	**156.76**
Grand Total	**120.11**	**89.51**	**2712.06**	**553.22**	**1174.44**		**99.28**	**618.06**	**59.83**	**157.84**	**5584.35**

6. In T2 01 ha of the agriculture area has decreased and it is converted into mining/dump (0.16 ha), plantations/horticulture (0.10 ha) and water body (0.81 ha) in T3.

7. In T3 62 ha of the agriculture area has increased from plantations/horticulture (24.5 ha), scrubland (37 ha) and water body (0.37 ha) of T2.

Table 7. showing change matrix depicting Land cover transitions for Chinnamandem Watershed (IWMP-40/2012-13) during study period-2018-19 to 2019-20

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	119.53		0.49	0.09							**120.11**
Mining/dump	0.06	89.29	0.15								**89.51**
Agriculture	5.45	1.34	2353.58	351.41						0.28	**2712.06**
Plantation Horticulture	0.53		15.98	536.71							**553.22**
Forest				0.27	1174.17						**1174.44**
Forest Plantation											
Barren Rocky							99.28				**99.28**
Scrub	0.72	0.39	32.53	5.17				579.21		0.04	**618.06**
Waterbody-Streams/River	0.00		0.28						59.54		**59.83**
Waterbody – Ponds			3.41					0.10		154.34	**157.84**
Grand Total	**126.29**	**91.02**	**2406.42**	**893.64**	**1174.17**		**99.28**	**579.31**	**59.54**	**154.67**	**5584.35**

8. In T3 358 ha of the agriculture area has decreased and it is converted into Built-up (5.4 ha), mining/dump (1.3 ha), plantations/horticulture (351 ha) and water body (0.28 ha) in T4.

9. In T4 52 ha of the agriculture area has increased from Built-up (0.49 ha), mining/dump (0.15 ha), plantations/horticulture (15 ha), scrubland (32.5 ha) and water body (3.7 ha) of T3.

Table 8. showing change matrix depicting Land cover transitions for Chinnamandem Watershed (IWMP-40/2012-13) during study period-2019-20 to 2020-21

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	124.93									1.36	**126.29**
Mining/dump		91.02									**91.02**
Agriculture	0.19		2396.69	7.26						1.59	**2405.74**
Plantation Horticulture			176.03	717.38							**893.42**
Forest					1174.17						**1174.17**
Forest Plantation											
Barren Rocky							99.28				**99.28**
Scrub			8.98					560.90		9.66	**579.54**
Waterbody-Streams/River									59.54		**59.54**
Waterbody – Ponds										155.35	**155.35**
Grand Total	**125.12**	**91.02**	**2581.70**	**724.64**	**1174.17**		**99.28**	**560.90**	**59.54**	**167.96**	**5584.35**

10. In T4 09 ha of the agriculture area has decreased and it is converted into built-up (0.19 ha), plantations/horticulture (7.2 ha) and water body (1.5 ha) in T5.

11. In T5 185 ha of the agriculture area has increased from plantations/horticulture (176 ha) and scrubland (8.9 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 24 Hectares in Reservoir / Tanks area as compared between baseline Land Use/Land Cover data 2012-13 (T0) & 2020-21 (T5) years.
3. There is an increase of 16, 61 & 175 Hectares from T1-T2 , T2-T3 & T4-T5 there is a decrease of 166 & 305 Hectares from T0-T1 & T3-T4 respectively and overall decrease of 218 Hectares in Crop land area as compared between baseline Land Use/Land Cover data 2012-13 (T0) & 2020-21 (T5) years.
4. **About 393 Hectares of the plantation/horticulture area has been increased** in during the monitoring period of 2012-13 (T0) & 2019-20 (T5) years.
5. There is a decrease of 233 Hectares in Scrubland area as compared between 2012-13 (T0) & 2020-21 (T5) years.
6. Farm ponds (13) is visible on IWMP (Integrated Watershed Management Programme) Bhuvan Srishti portal out of Bhuvan Drishti photo of Farm ponds (13) 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