MONITORING OF IWMP WATERSHED PROJECTS USING GEO-INFORMATION

SUMMARY REPORT

CHITTOOR -08/2009-10
Andhra Pradesh

Submitted to NRSC, Balanagar, Hyderabad
January-2021

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**

EXECUTIVE SUMMARY

- Integrated Watersheds Management Project (IWMP) is a flagship programme of Department of Land Resources (DoLR), Ministry of Rural Development (MRD).

- 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).

- Current summary report gives details of Project– IWMP-08/2009-10, Chittoor District of Andhra Pradesh. The total geographical area of the project is 6012.04 ha. It comprises of 7 micro watersheds.

- In the project area 113 Drishti photos were uploaded showing 99 water harvesting structures of farm ponds/dug out pits, recharge pits, 5 Land development activities of afforestation, horticulture and bund plantation of teak and remaining other activities.

- Project area as per image analysis has witnessed distinguishable increase in farm ponds, showing new farm ponds or dug out pits and drainage treatments with 11.72 ha increase in the area.

- Major percentage i.e. 50.28 % is covered by the agriculture, 16.81 % is covered by forest, 22.98 % is covered by scrub land and remaining by other land use classes.

PROJECT : CHITTOOR - IWMP-08/2009-10
DISTRICT : CHITTOOR , STATE : ANDHRA PRADESH

- The study area falls in Madanapalle Mandal of Chittoor district of Andhra Pradesh state. The total geographical area of the project is 6012.04 ha. It comprises of 7 micro watersheds. Location Map of the study area is shown in Figure below. Analysis is done for 2009-10 (T0) period (*Batch -1*) projects taking 2017-18 (T5) period satellite images
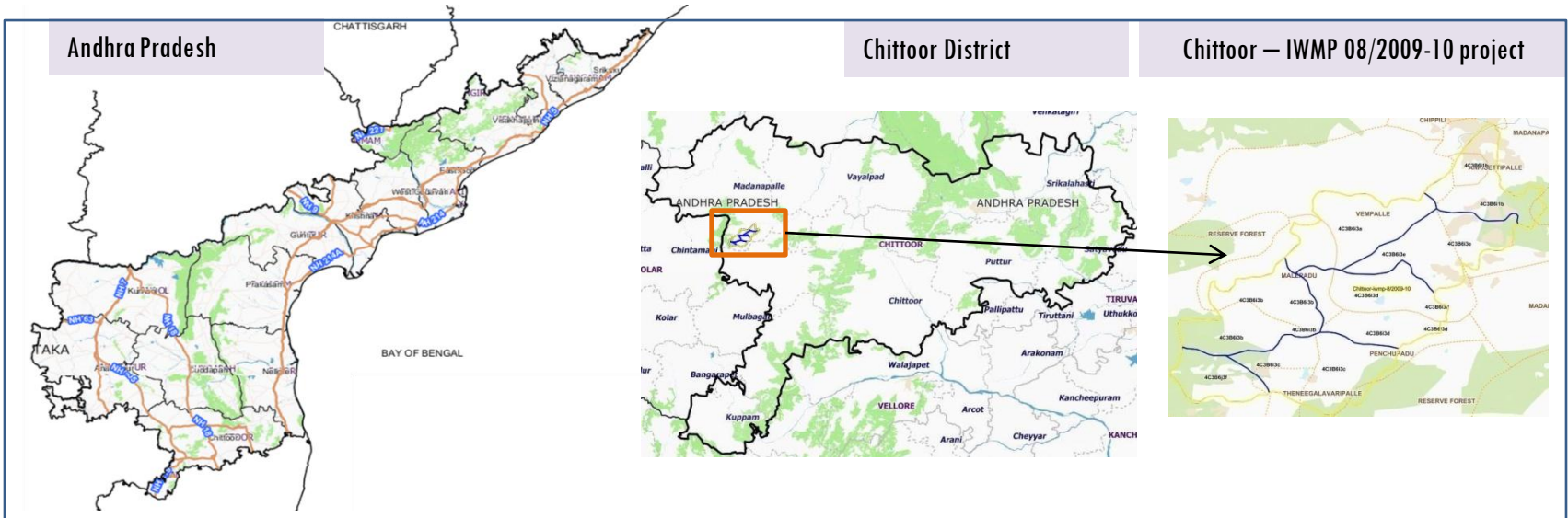
- The climate of the district is dry and healthy. Out of 66 mandals in the district, 31 are upland mandals which are located in Madanapalle division and are comparatively cooler than the eastern mandals except Chittoor mandal where the climate is moderate. December and January are the coldest months 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.

Satellite Data and Ancillary Data

Satellite data*	T0-A**	T0-B**	T5
	2009-10	2011-12	2017-18
LISS IV	2009-10		
SCENE 1			1-Mar-18
SCENE2			
SCENE 3			
SCENE 4			
CARTO	2009-10		
SCENE 1			1-Mar-18
SCENE2			
SCENE 3			
SCENE 4			

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	113
4	Detailed Project Report		

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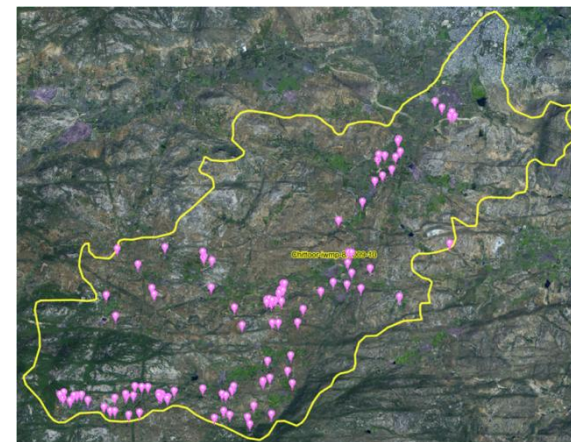

Legend

 Drainage (1:10000 Scale)

 MWS Boundary

 Project Boundary

Natural Color Composite overlaid with Drishti Points

Drishti Upload Status

Classification of the Activities

| Sr. No	Activity	Drishti Photo	Visible on satellite
1	Agriculture/Horticulture	5	4
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 and Plugs	3	3
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/Recharge pits	99	65
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(cattle trough and solar street light)	6	0
18	Others	0	0
	TOTAL	**113**	**72**

MONITORING IN THE PROJECT AREA

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 (2009-10) and T5 is 2017-18 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.

Natural Color Composite — 2009-10 to 2017-18

Natural Color Composite- 2009-10
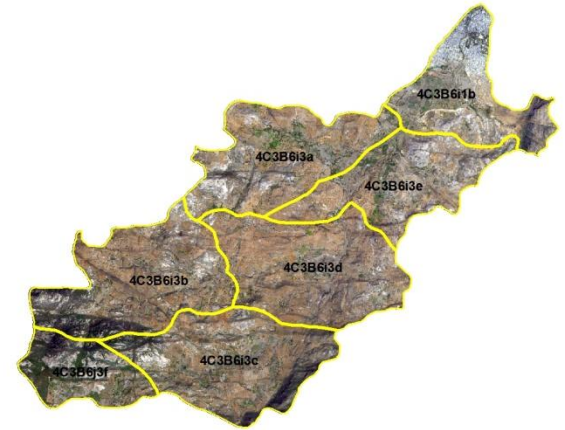Source:Fusen data,NRSC
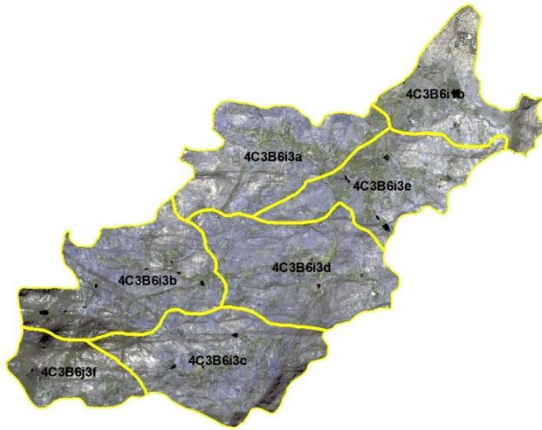
Natural Color Composite-2013-2014
Source:Fusen data,NRSC

Natural Color Composite- 2014-2015
Source:Fusen data,NRSC
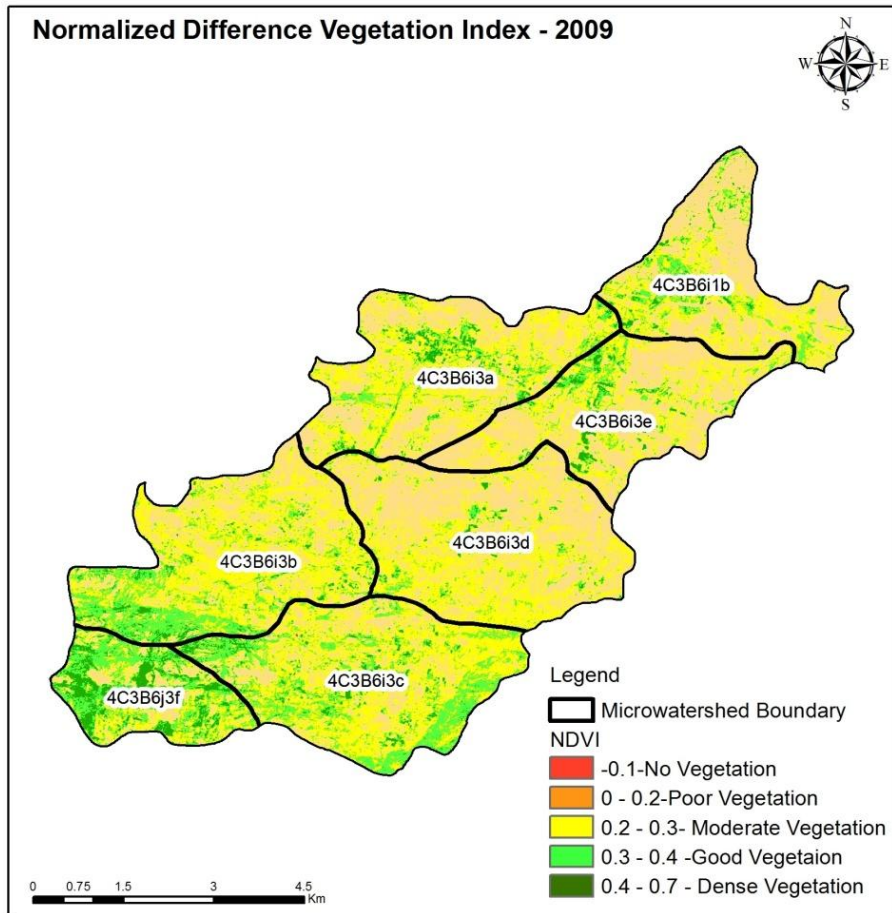
Natural Color Composite- 2015-2016
Source:Fusen data,NRSC

Natural Color Composite- 2016-2017
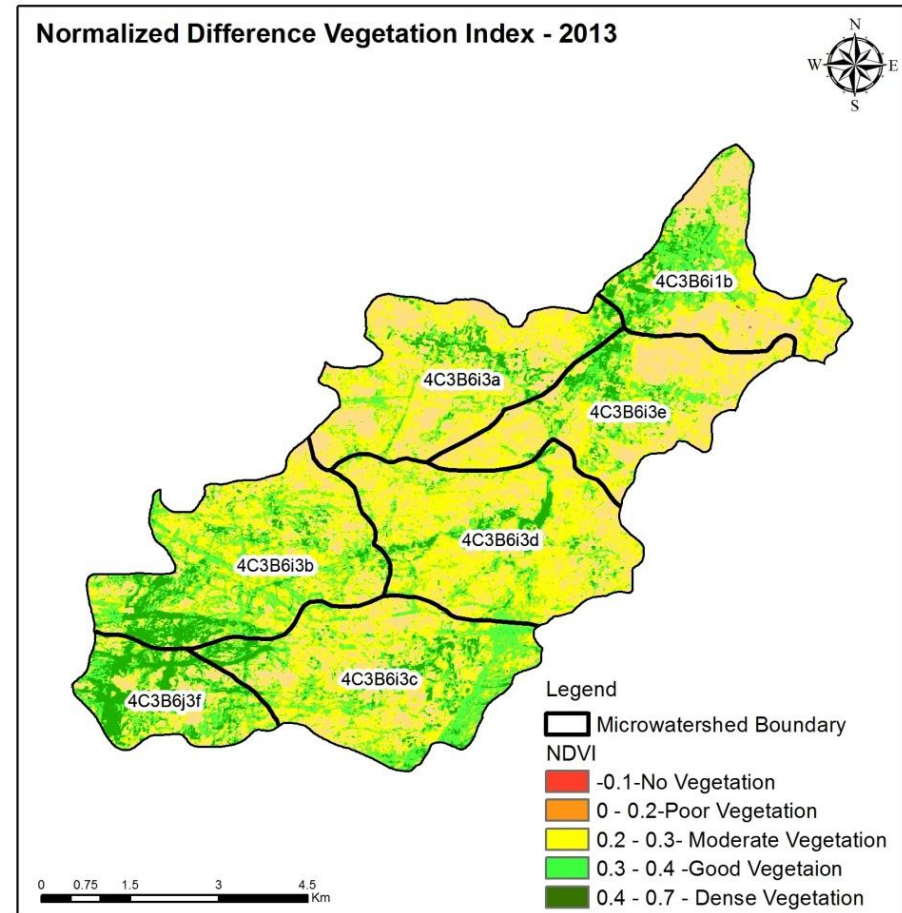Source:LISS-IV,NRSC

Changes in Vegetation Cover

Normalized Difference Vegetation Index - 2009

4C3B6i1b

4C3B6i3a

4C3B6i3e

4C3B6i3b

4C3B6i3d

4C3B6j3f

4C3B6i3c

Legend

Microwatershed Boundary

NDVI

- -0.1-No Vegetation
- 0 - 0.2-Poor Vegetation
- 0.2 - 0.3- Moderate Vegetation
- 0.3 - 0.4 -Good Vegetaion
- 0.4 - 0.7 - Dense Vegetation

0   0.75   1.5   3   4.5
Km

Normalized Difference Vegetation Index - 2013

4C3B6i1b

4C3B6i3a

4C3B6i3e

4C3B6i3b

4C3B6i3d

4C3B6j3f

4C3B6i3c

Legend

Microwatershed Boundary

NDVI

- -0.1-No Vegetation
- 0 - 0.2-Poor Vegetation
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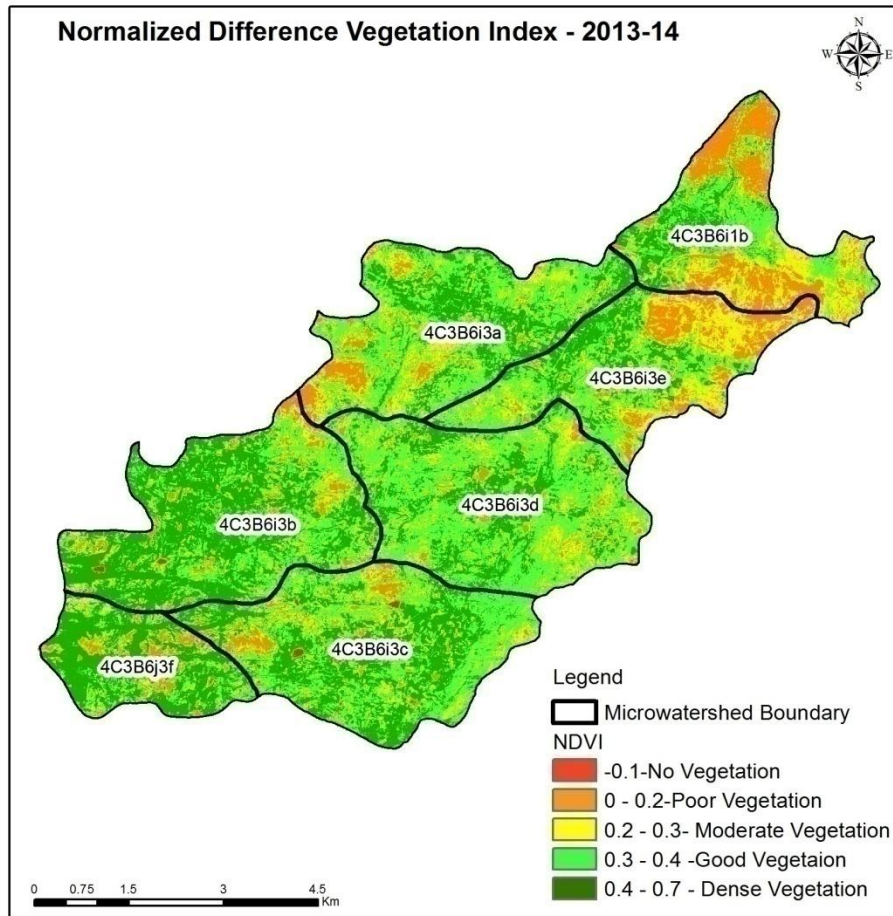
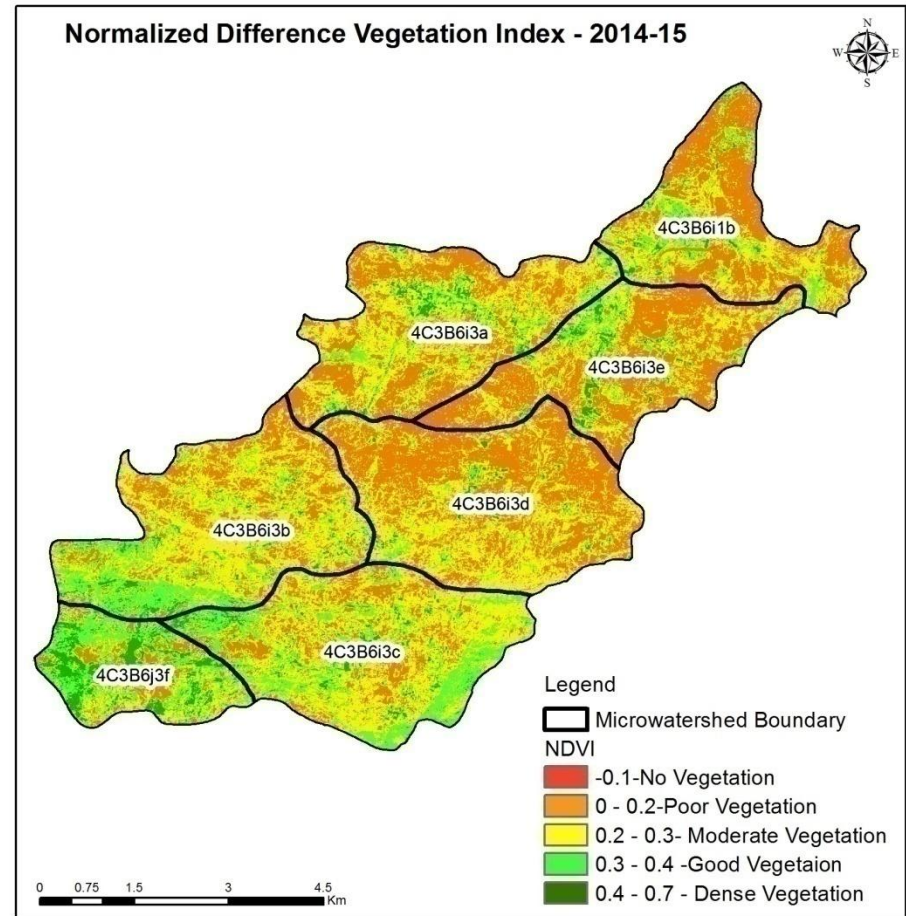0   0.75   1.5   3   4.5
Km

NDVI (2009-10)

NDVI (2013-14)

Changes in Vegetation Cover

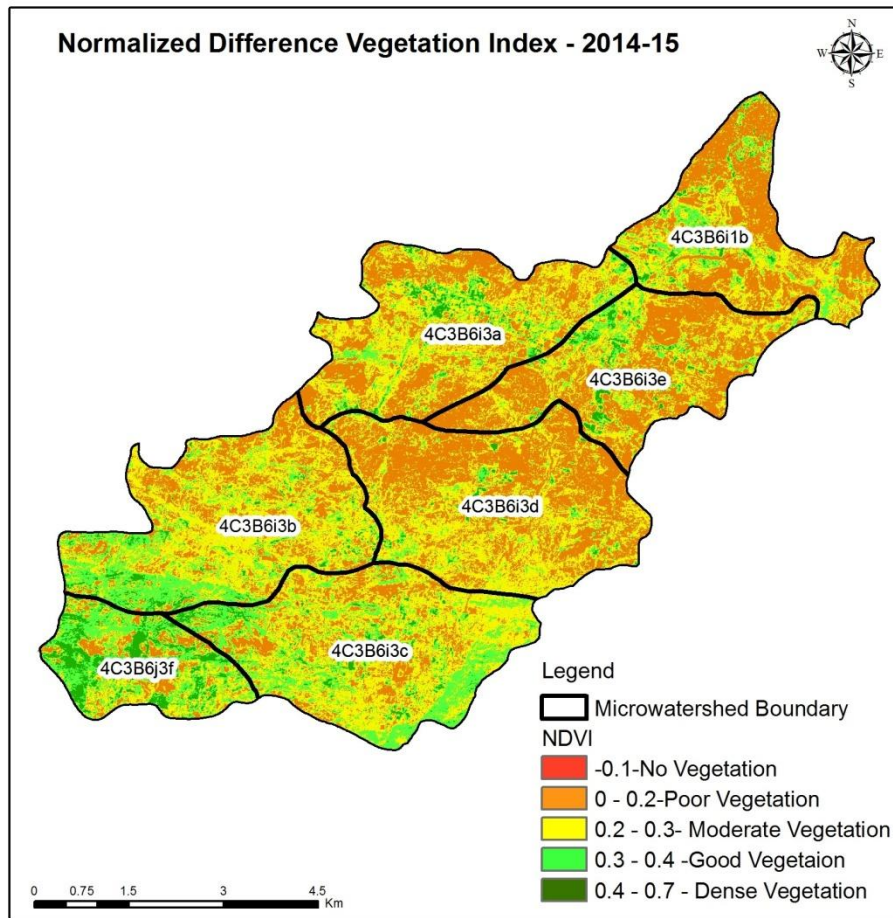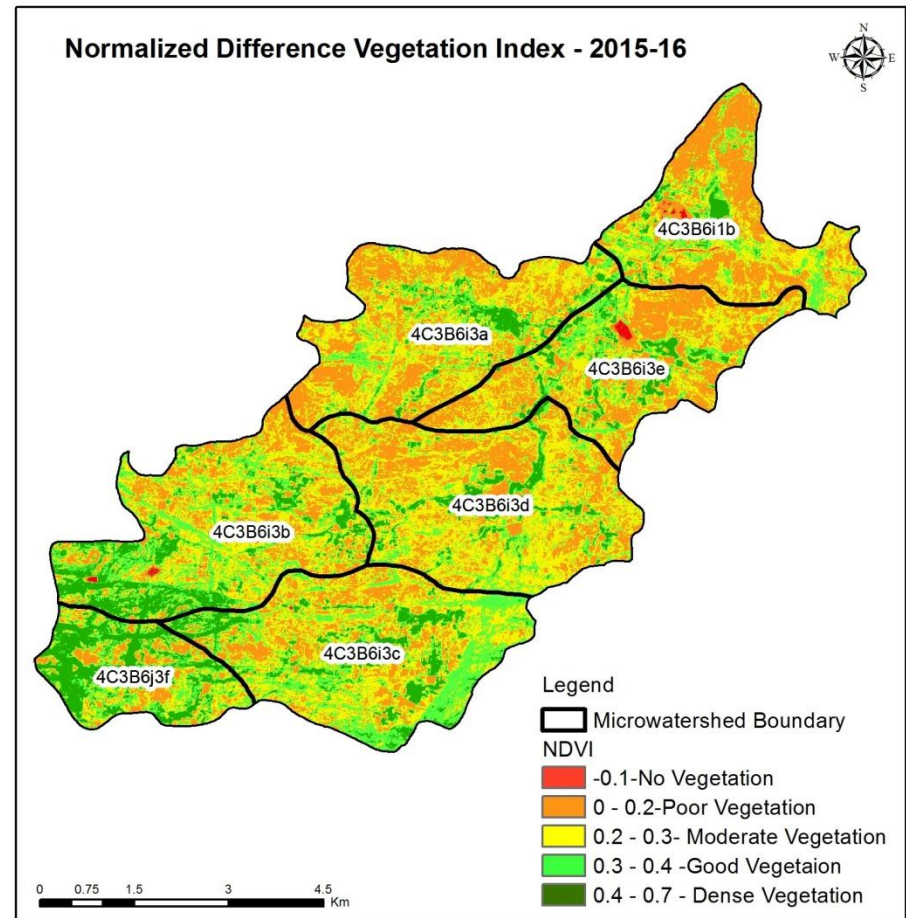

NDVI (2013-14)

NDVI (2014-15)

Changes in Vegetation Cover

NDVI (2014-15)

NDVI (2015-16)

Monitoring of activities in Chittoor Dt Andhra Pradesh. IWMP-08/2009-10

| T0:2009-10 | T1: 30 January 2014 | Drishti Sl no. 587487   MWS :4C3B6i3d |

Check dam

| T0:2009-10 | T1: 30 January 2014 | Drishti Sl no. 840134   MWS : 4C3B6i3c |

Farm pond

Monitoring of activities in Chittoor Dt Andhra Pradesh. IWMP-08/2009-10

| T0: 2009-10 | T1: 30 January 2014 | Drishti Sl no. 733302   MWS : 4C3B6j3c |

Groundwater Recharge Structure

| T0: 2009-10 | T1: 30 January 2014 | Drishti Sl no. 848662   MWS : 4C3B6j3f |

Horticulture

Monitoring of activities in Chittoor Dt Andhra Pradesh. IWMP-08/2009-10

| T0: 2009-10 | T1: 30 January 2014 | Drishti Sl no. 840160   MWS : 4C3B6j3f |

Farm pond

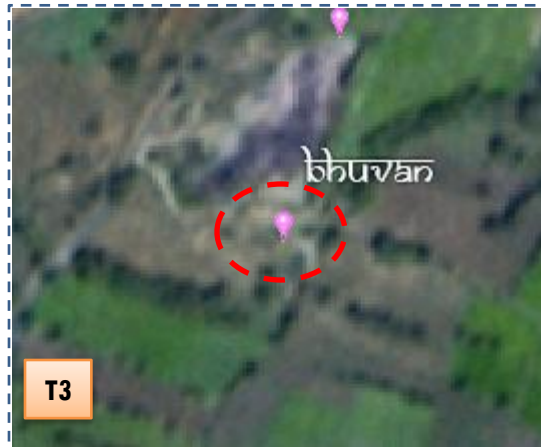| T0: 2009-10 | T1: 30 January 2014 | Drishti Sl no. 850502   MWS : 4C3B6j3b |

Percolation tank

Monitoring of activities in Chittoor Dt Andhra Pradesh. IWMP-08/2009-10

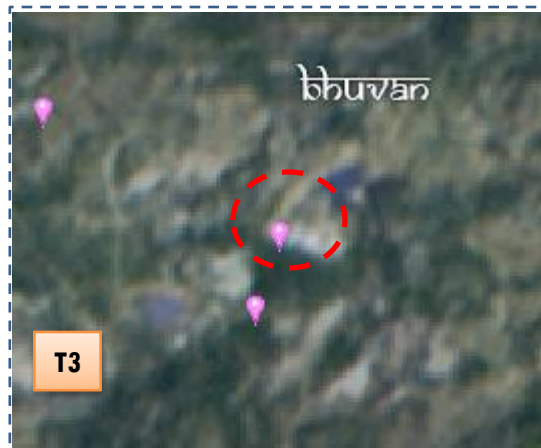| T2	T3	
T2:2014	T3: 24 December 2015	Drishti Sl no. 587487 MWS :4C3B6i3d

Check dam
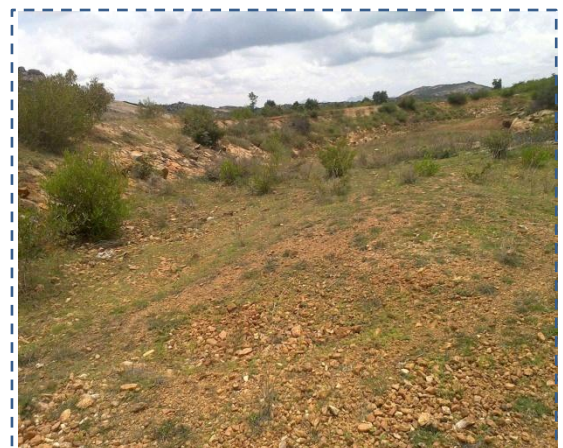
T2	T3	
T2:2014	T3: 24 December 2015	Drishti Sl no. 840134 MWS : 4C3B6i3c

Percolation Tank

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.

- 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.

- The result obtained for the period T0 to T5 are given in the change matrix table.

- In matrix table column represents the T0 (2009-10) and row represents the T5 (2017-18)

Comparative assessment of Land Use and Land Cover for Pre and Post IWMP implementation (2009-10 to 2013-14)

Scale: 1:10000
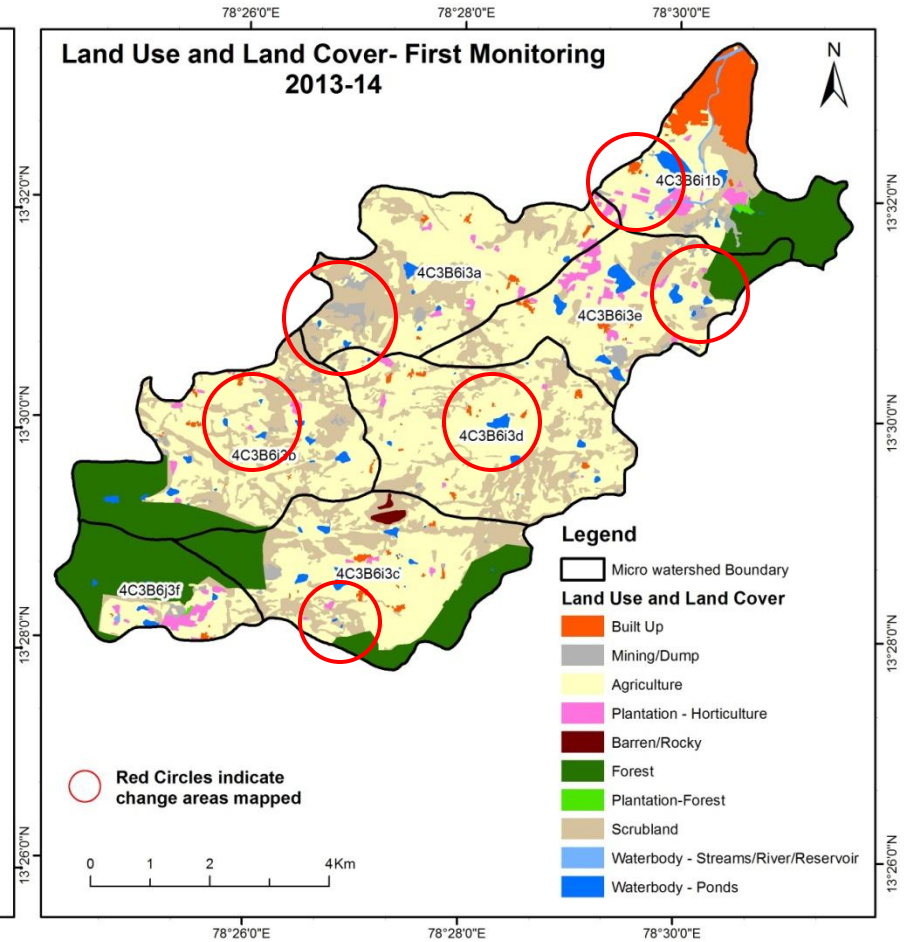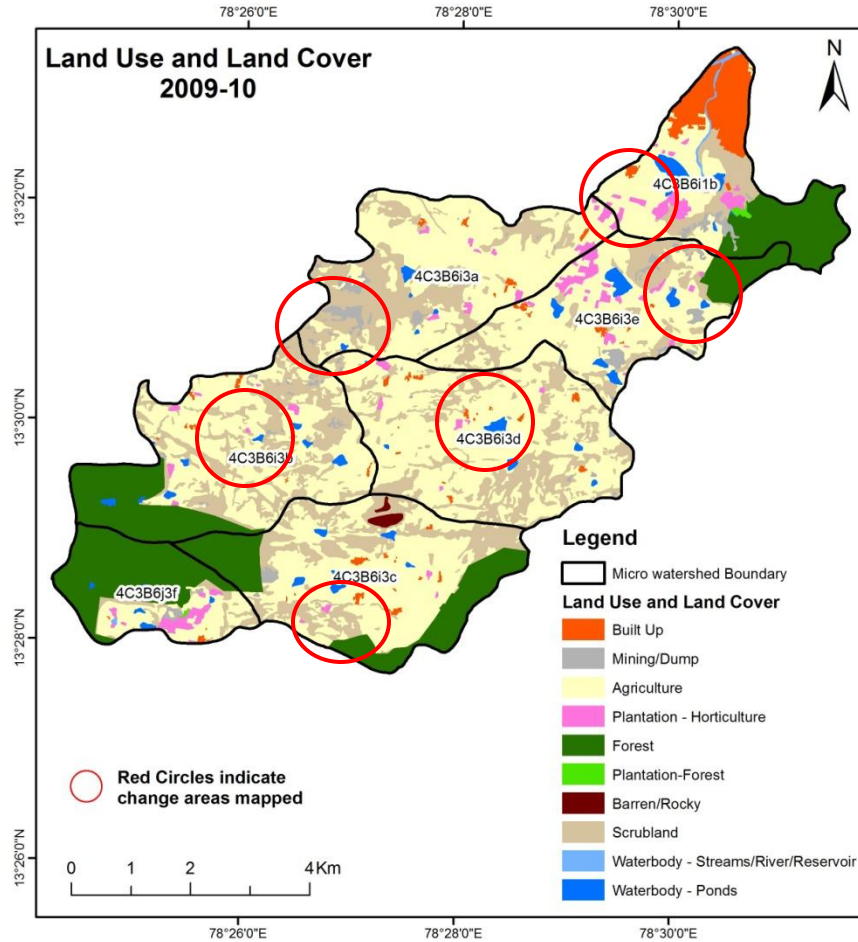
Land Use and Land Cover 2009-10

Land Use and Land Cover- First Monitoring 2013-14

Legend

Micro watershed Boundary

Land Use and Land Cover

- Built Up
- Mining/Dump
- Agriculture
- Plantation - Horticulture
- Forest
- Plantation-Forest
- Barren/Rocky
- Scrubland
- Waterbody - Streams/River/Reservoir
- Waterbody - Ponds

Red Circles indicate change areas mapped

Comparative assessment of Land Use and Land Cover for Pre and Post IWMP implementation (2013-14 to 2014-15)
Scale: 1:10000

Land Use and Land Cover 2013-14

Legend

Microwatershed Boundary

Land Use and Land Cover
- Built Up
- Mining/Dump
- Agriculture
- Plantation - Horticulture
- Forest
- Barren/Rocky
- Scrubland
- Waterbody - Ponds
- Waterbody - Streams/River/Reservoir

Red Circles indicate change areas mapped

0 1 2 4 Km

4C3B6i1b
4C3B6i3a
4C3B6i3e
4C3B6i3b
4C3B6i3d
4C3B6i3c
4C3B6j3f

Land Use and Land Cover- Second Monitoring 2014-15

Legend

Microwatershed Boundary

Land Use and Land Cover
- Built Up
- Mining/Dump
- Agriculture
- Plantation - Horticulture
- Forest
- Barren/Rocky
- Scrubland
- Waterbody - Ponds
- Waterbody - Streams/River/Reservoir

Red Circles indicate change areas mapped

0 1 2 4 Km

4C3B6i1b
4C3B6i3a
4C3B6i3e
4C3B6i3b
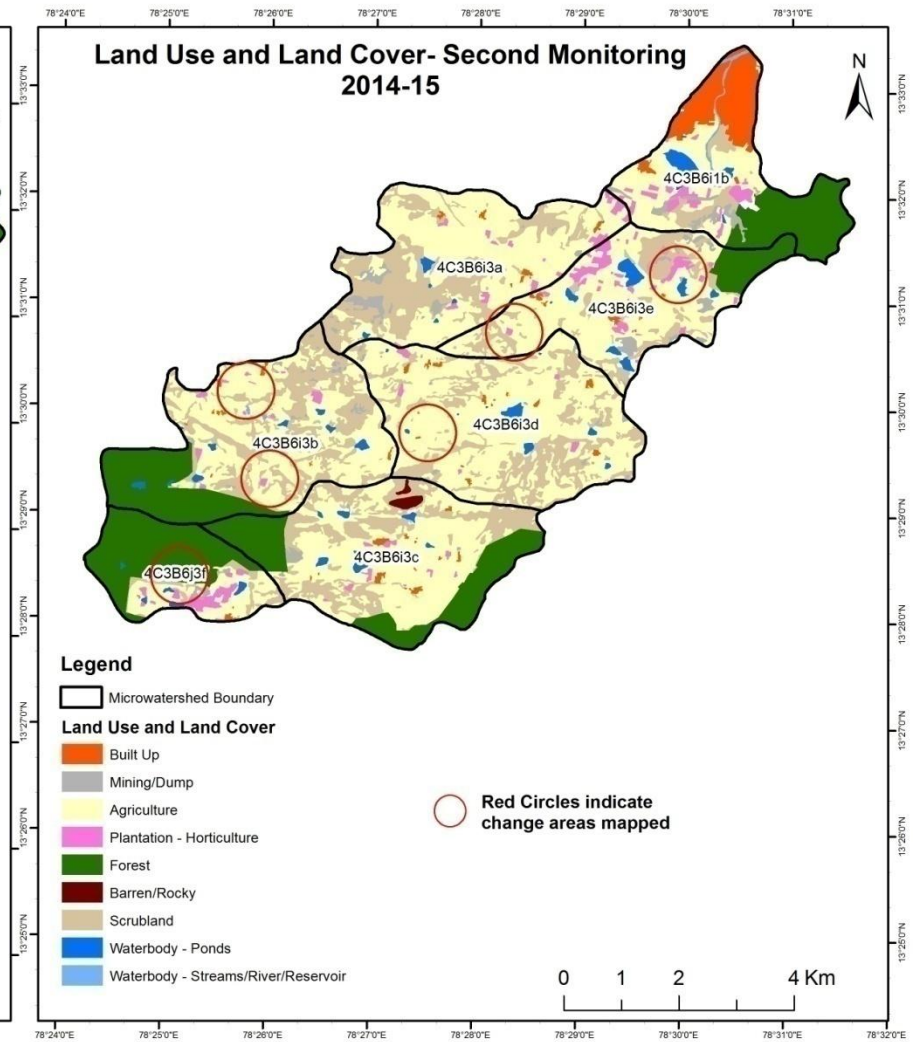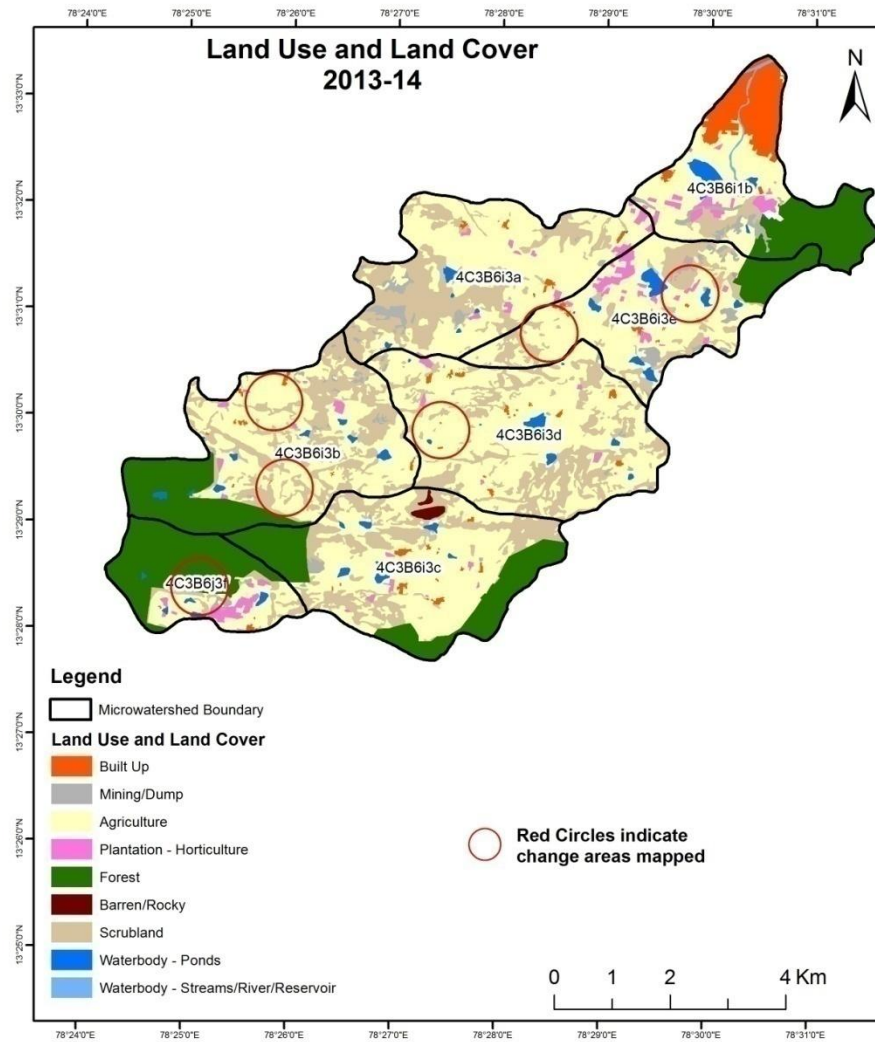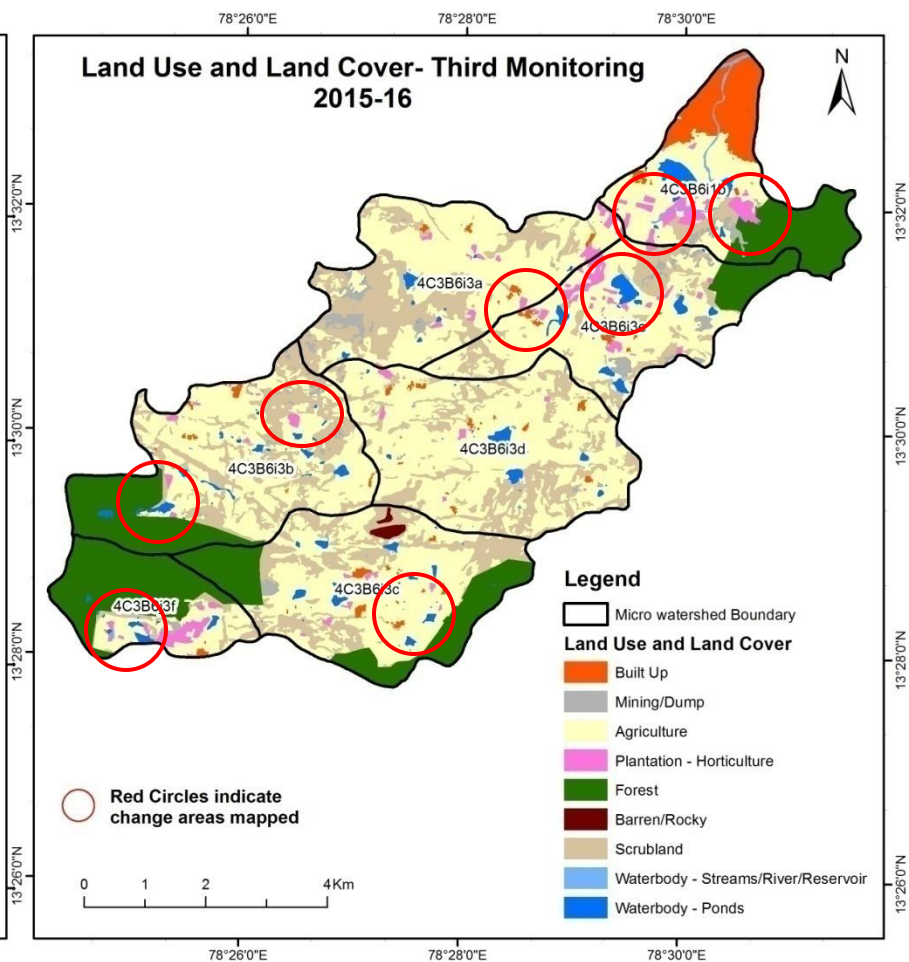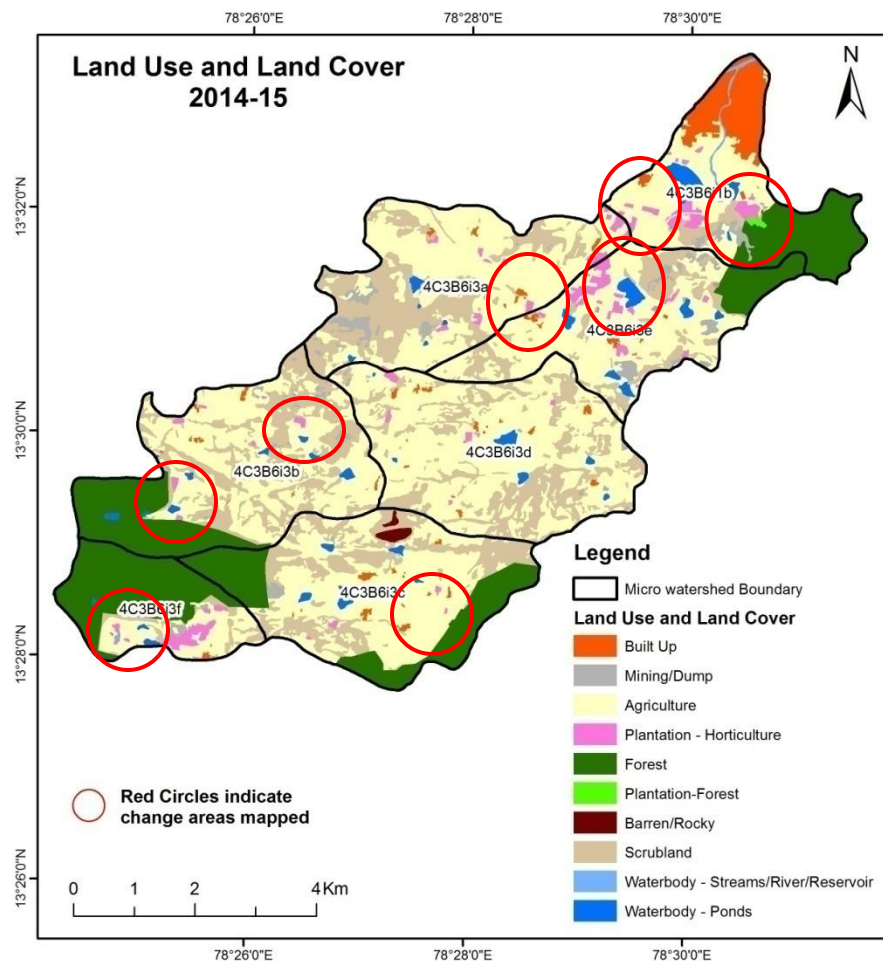4C3B6i3d
4C3B6i3c
4C3B6j3f

Comparative assessment of Land Use and Land Cover for Pre and Post IWMP implementation (2014-15 to 2015-16)

Scale: 1:10000

Comparative assessment of Land Use and Land Cover for Pre and Post IWMP implementation (2015-16 to 2016-17)
Scale: 1:10000

Land Use and Land Cover 2015-16

N

Legend

Microwatershed Boundary

Land Use and Land Cover

Built Up
Barren/Rocky
Mining/Dump
Agriculture
Forest
Plantation - Horticulture
Scrubland
Waterbody - Ponds
Waterbody - Streams/River/Reservoir

Red Circles indicate change areas mapped

0 1 2 4 Km

Land Use and Land Cover- Fourth Monitoring 2016-17

N

Legend

Microwatershed Boundary

Land Use and Land Cover

Built Up
Barren/Rocky
Mining/Dump
Agriculture
Forest
Plantation - Horticulture
Scrubland
Waterbody - Ponds
Waterbody - Streams/River/Reservoir

Red Circles indicate change areas mapped

0 1 2 4 Km
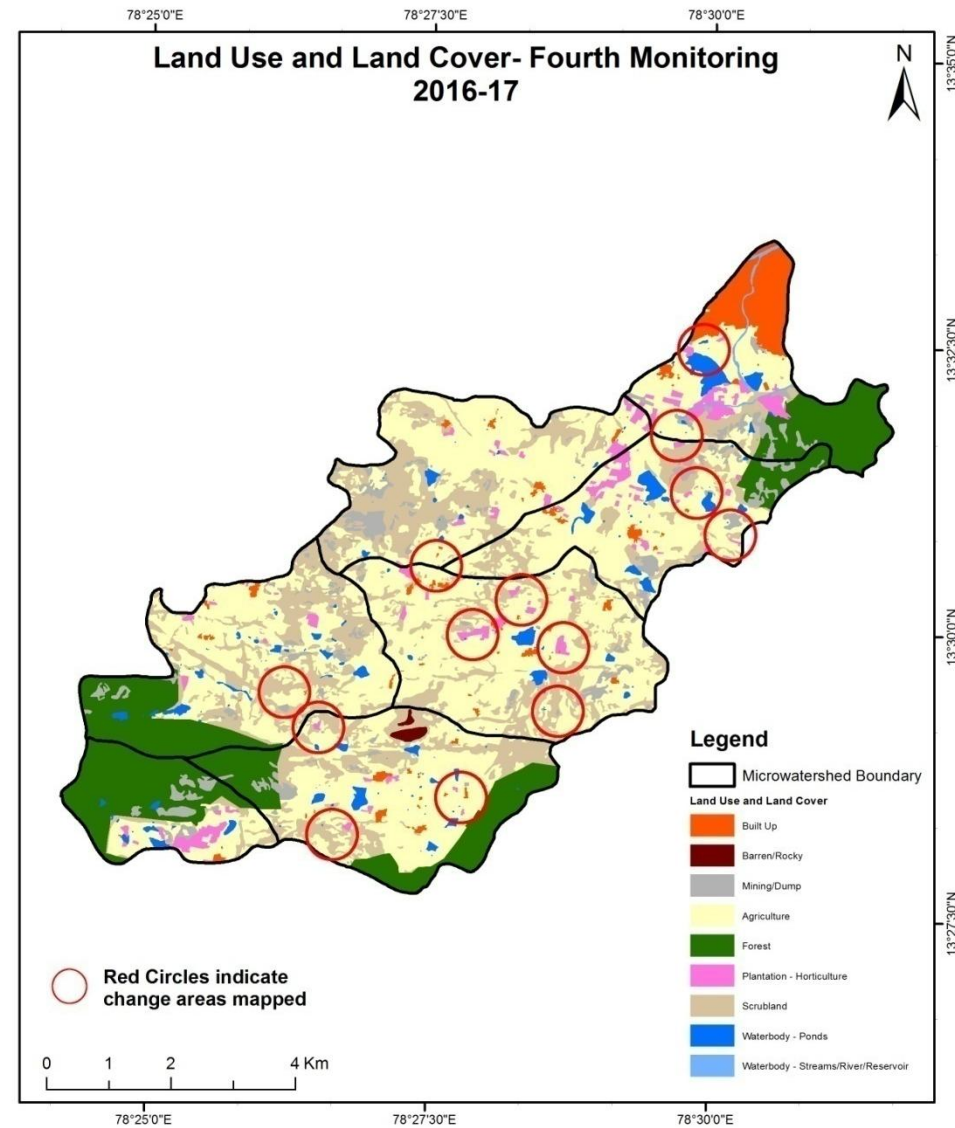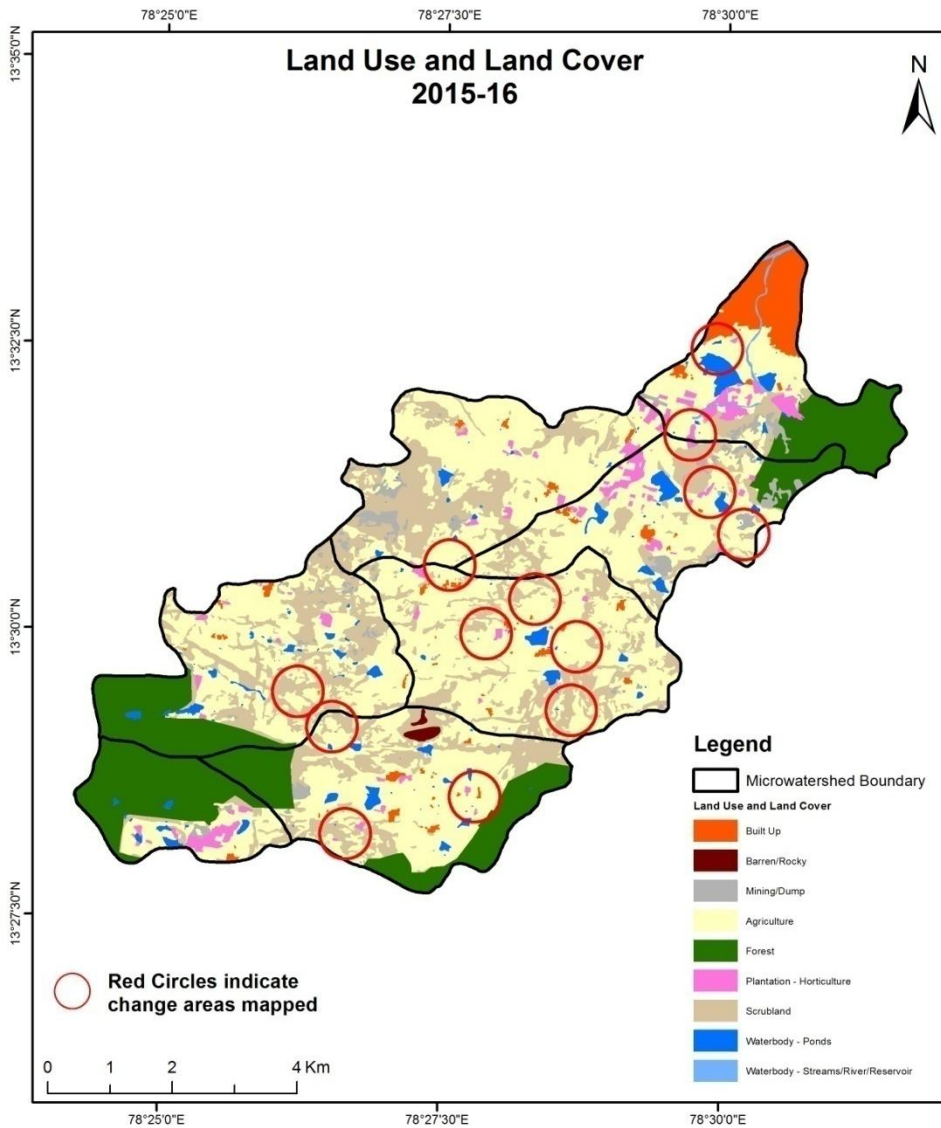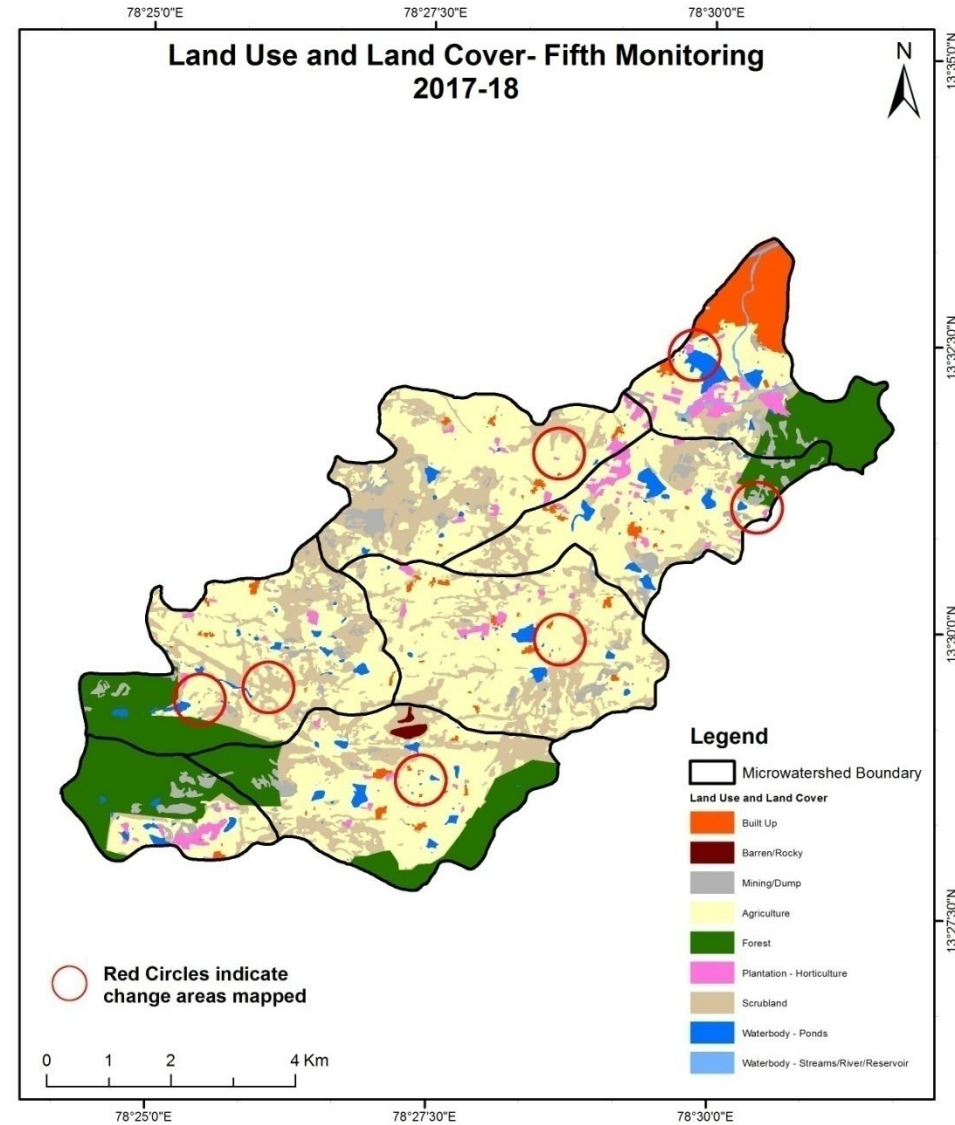
Comparative assessment of Land Use and Land Cover for Pre and Post IWMP implementation (2016-17 to 2017-18)
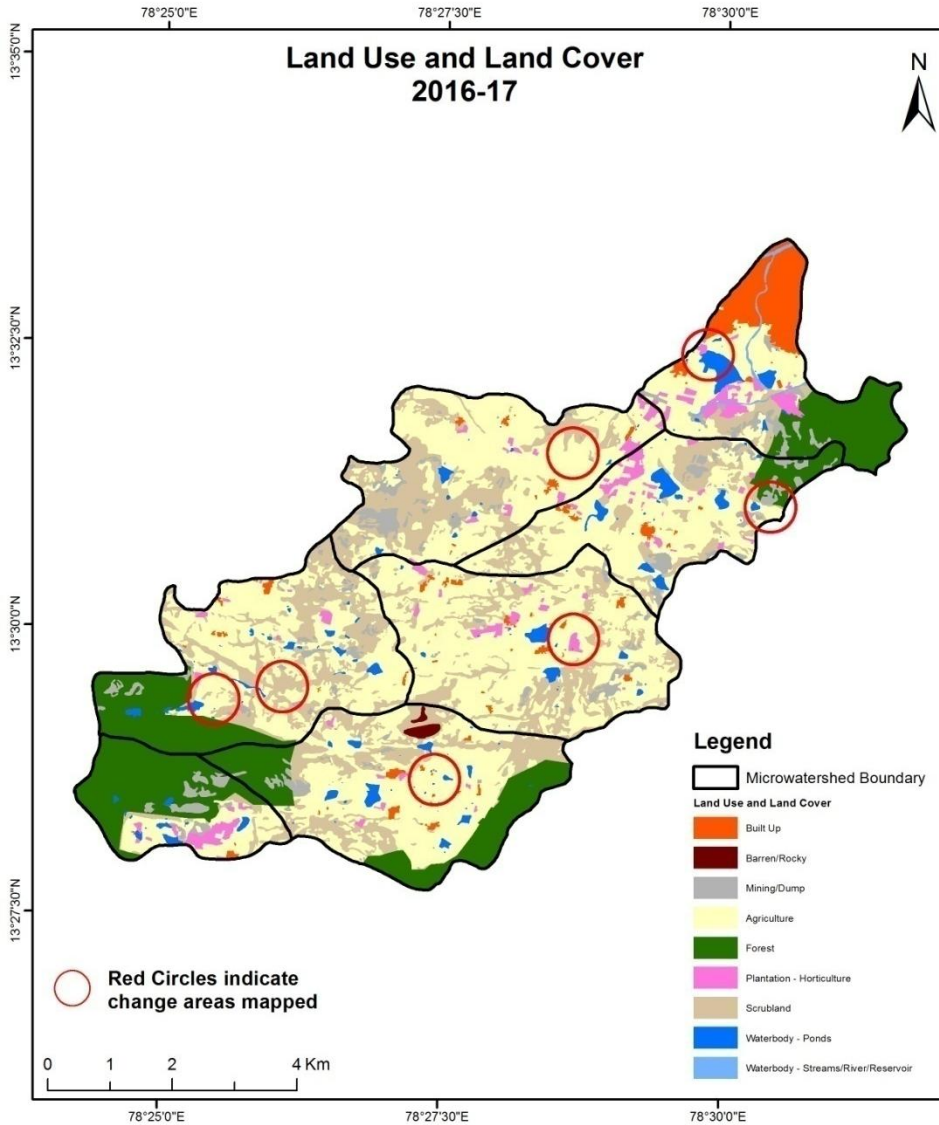## Scale: 1:10000

21

Land Use and Land Cover changes for Pre and Post treatment dates

Agriculture to Plantation

T0

T0: 2009-10

T1
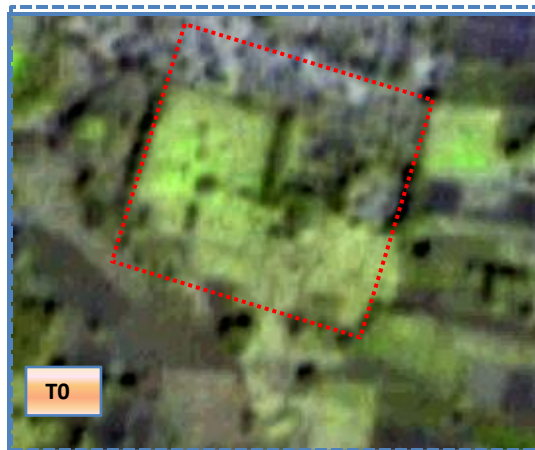
T1: 30 January 2014

Agriculture to Plantation

T0

T0: 2009-10

T1

T1: 30 January 2014

Land Use and Land Cover changes for Pre and Post treatment dates

Scrub to Water body

T0

T0: 2009-10

T1

T1: 30 January 2014

Forest to Water body

T0

T0: 2009-10

T1

T1: 30 January 2014

Table showing change matrix depicting Land cover transitions during study period-2009-10 to 2013-14

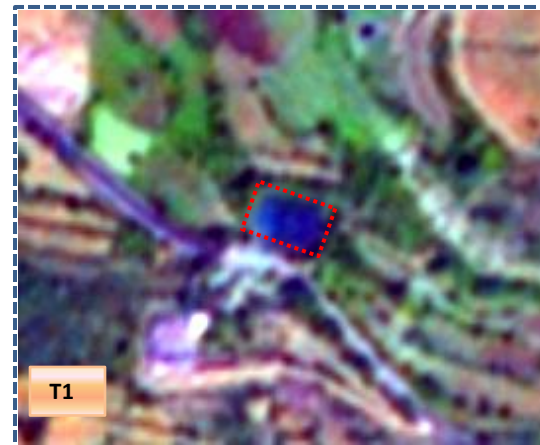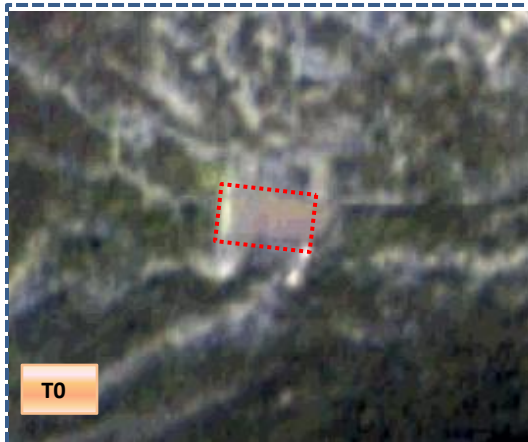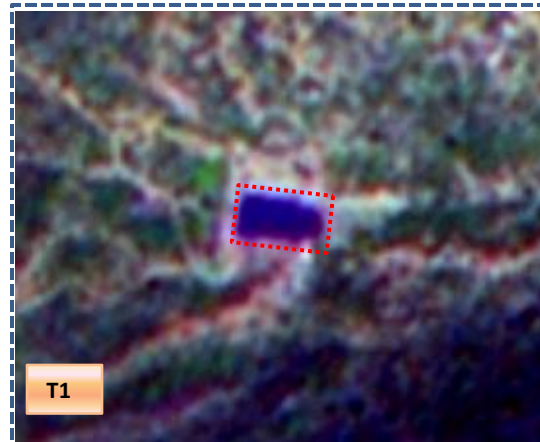| Land cover	Monitoring period (T1)									Units in Hectares	
T0	Built up	Mining/dump	Agriculture	Plantation Horticulture	Forest	Forest Plantation	Barren Rocky	Scrub	Waterbody-Streams/River	Water body Ponds	Grand Total
Built up	185.23										185.23
Mining/dump		107.25									107.25
Agriculture	0.88		3029.90	5.39						0.12	3036.29
Plantation Horticulture			2.83	124.59							127.43
Forest					1006.05						1006.05
Forest Plantation						4.06					4.06
Barren Rocky							12.25				12.25
Scrub		1.60	1.94					1404.02		1.48	1409.04
Waterbody-Streams/River									10.83		10.83
Waterbody – Ponds										113.61	113.61
Grand Total	186.11	108.85	3034.68	129.99	1006.05	4.06	12.25	1404.02	10.83	115.21	6012.04

- In matrix table diagonal elements represent the both periods in the same class and off diagonal elements represents change in between the classes.
- In T0 6.39 ha of the agriculture area has decreased and it is converted into Built-up, plantation and water body in T1.
- In T1 4.77 ha of the agriculture area has increased from scrubland and plantation area of T0.
- Overall 1.61 ha of the agriculture area has been decreased.
- The additional agriculture are coming from waterbody in T1 represents seasonal agriculture.

Table showing change matrix depicting Land cover transitions during study period-2013-14 to 2014-15

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	186.11										186.11
Mining/dump		108.85									108.85
Agriculture			3033.42	1.26							3034.68
Plantation Horticulture			5.18	124.81							129.99
Forest					1006.05						1006.05
Forest Plantation						4.06					4.06
Barren Rocky							12.25				12.25
Scrub			0.84					1403.18			1404.02
Waterbody-Streams/River									10.83		10.83
Waterbody – Ponds										115.21	115.21
Grand Total	186.11	108.85	3039.44	126.06	1006.05	4.06	12.25	1403.18	10.83	115.21	6012.04

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

• In T1 1.26 ha of the agriculture area has decreased and it is converted into plantation in T2.

• In T2 6.02 ha of the agriculture area has increased from scrubland and plantation of T1.

• Overall 4.76 ha of the agriculture area has been Increased. The additional agriculture are coming from waterbody in T2 represents seasonal agriculture.

Table showing change matrix depicting Land cover transitions during study period-2014-15 to 2015-16

Land cover / T2	Monitoring period (T3) Built up	Mining/dump	Agriculture	Plantation Horticulture	Forest	Forest Plantation	Barren Rocky	Scrub	Waterbody-Streams/River	Water body Ponds	Grand Total (Units in Hectares)
Built up	186.11										186.11
Mining/dump		108.70								0.15	108.85
Agriculture	23.94	5.24	2948.48	28.94				0.69	3.54	28.60	3039.44
Plantation Horticulture	0.16		4.62	121.16						0.13	126.06
Forest		10.68			995.10					0.27	1006.05
Forest Plantation				3.80						0.26	4.06
Barren Rocky							12.25				12.25
Scrub	0.45	6.62	56.45					1336.76		2.90	1403.18
Waterbody-Streams/River									10.83		10.83
Waterbody – Ponds										115.21	115.21
Grand Total	210.65	131.24	3009.54	153.90	995.10		12.25	1337.45	14.38	147.52	6012.04

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

• In T2 90.97 ha of the agriculture area has decreased and it is converted into Built-up, mining/dump, plantation, scrub and water body in T3.

• In T3 61.07 ha of the agriculture area has increased from scrubland and plantation of T2 and overall 21.90 ha of the agriculture area has been decreased from T2 to T3. The additional agriculture are coming from waterbody in T3 represents seasonal agriculture.

Table showing change matrix depicting Land cover transitions during study period-2015-16 to 2016-17

Land cover / 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 (Units in Hectares)
Built up	210.65										210.65
Mining/dump		131.24									131.24
Agriculture	1.89	13.91	2971.52	20.75					0.98	0.50	3009.54
Plantation Horticulture			10.58	142.88					0.45		153.90
Forest		57.80			937.29						995.10
Forest Plantation											
Barren Rocky							12.25				12.25
Scrub	0.66	59.55	3.90	0.25				1272.42	0.41	0.27	1337.45
Waterbody-Streams/River									14.38		14.38
Waterbody – Ponds										147.52	147.52
Grand Total	213.20	262.50	2985.99	163.88	937.29		12.25	1272.42	16.21	148.29	6012.04

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

• In T3 38.02 ha of the agriculture area has decreased and it is converted into Built-up, mining/dump, plantation and water body in T4.

• In T4 14.47 ha of the agriculture area has increased from scrubland and plantation of T3 and overall 23.55 ha of the agriculture area has been decreased from T3 to T4. The additional agriculture are coming from waterbody in T4 represents seasonal agriculture.

Table showing change matrix depicting Land cover transitions during study period-2016-17 to 2017-18

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	213.20										213.20
Mining/dump		260.85	1.65								262.50
Agriculture	0.88	0.22	2980.65	2.89						1.36	2985.99
Plantation Horticulture	0.07		9.32	154.49							163.88
Forest					937.29						937.29
Forest Plantation											
Barren Rocky							12.25				12.25
Scrub		0.67	7.37					1264.25		0.14	1272.42
Waterbody-Streams/River									16.21		16.21
Waterbody – Ponds										148.29	148.29
Grand Total	214.15	261.74	2998.98	157.38	937.29		12.25	1264.25	16.21	149.79	6012.04

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

• In T4 5.35 ha of the agriculture area has decreased and it is converted into Built-up, mining/dump, plantation and water body in T5.

• In T5 16.69 ha of the agriculture area has increased from mining dump , scrubland and plantation of T4 and overall 12.99 ha of the agriculture area has been increased from T4 to T5. The additional agriculture are coming from waterbody in T5 represents seasonal agriculture.

Conclusion

1.   DPR of the project is uploaded on to Bhuvan Portal.

2.   The LULC 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.

3.   There is an increase of 41.55 Hectares in Reservoir / Tanks area as compared between baseline LU/LC data 2009-10 (T0) & 2017-18 (T5) years.

4.   There is an increase of 4.76& 12.99 Hectares From T1-T2 & T4-T5 respectively and overall increase of 17.75 Hectares in Crop land area as compared between baseline LU/LC data 2009-10 (T0) & 2017-18 (T5) years.

5.   There is a increase of 29 Hectares in Plantation/Horticulture area as compared between 2009-10 (T0) & 2017-18 (T5) years.

6.   There is a decrease of 8.17 Hectares in Scrubland area as compared between 2009-10 (T0) & 2017-18 (T5) years.