

# MONITORING OF IWMP WATERSHED PROJECTS USING GEO-INFORMATION

## SUMMARY REPORT

YSR KADAPA -13/2010-11  
Andhra Pradesh

Submitted to NRSC, Balanagar, Hyderabad  
July-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

- **EXECUTIVE SUMMARY**

- 01. STUDY AREA
- 02. SATELLITE & ANCILLARY DATA INCLUDING DRISHTI STATUS
- 03. MONITORING IN THE PROJECT AREA : Site wise changes in the project
- 04. CONCLUSIONS

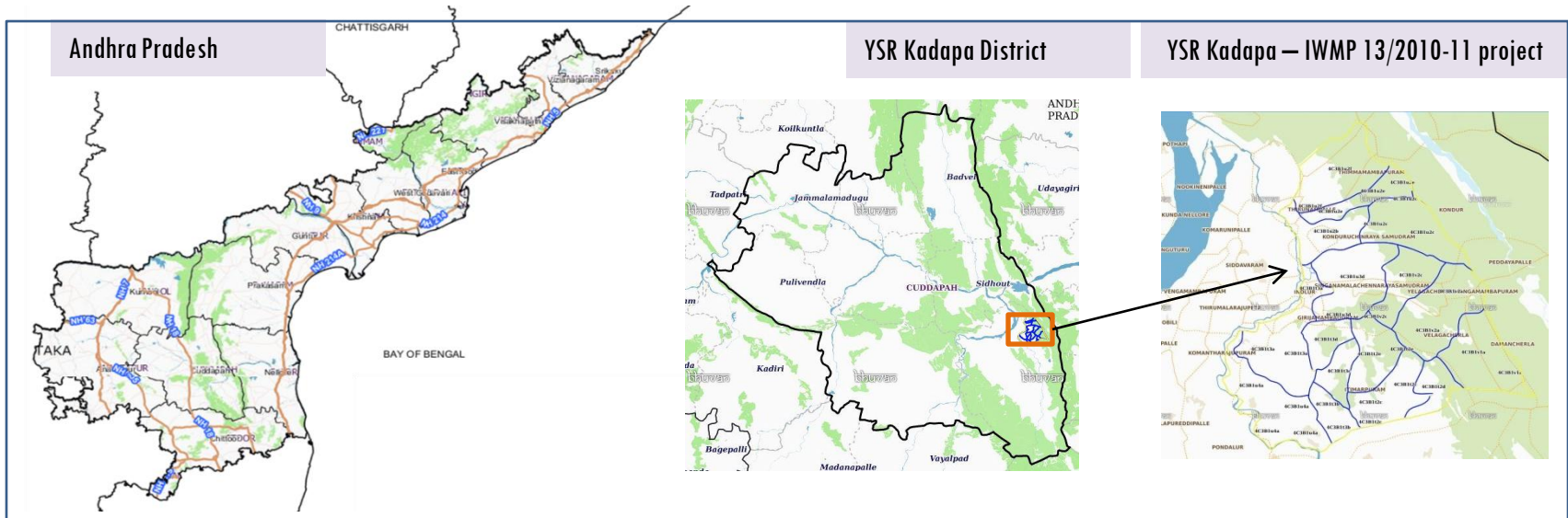
## **E X E C U T I V E   S U M M A R Y**

- 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-13/2010-11, YSR Kadapa District of Andhra Pradesh. The total geographical area of the project is 10,507 ha. It comprises of 16 micro watersheds.
- In the project area 210 Drishti photos were uploaded showing 15 check dams/Rock fill dam, 4 livelihood activities, and remaining showing other activities.
- Water bodies have shown an decrease by 23 ha , which correspond to the various bodies that have been converted into other land use classes in this period..
- Major percentage i.e. 57 % is covered by the scrubland, 17 % is agriculture, 10 % is covered by plantations, 11.23 % is forest area and remaining by other land use classes.

# PROJECT : YSR KADAPA - IWMP-13/2010-11

## DISTRICT : YSR KADAPA , STATE : ANDHRA PRADESH

- The study area falls in Penagalur Mandal of YSR Kadapa district of Andhra Pradesh state. The total geographical area of the project is 10,507 ha. It comprises of 16 micro watersheds. Location Map of the study area is shown in Figure below. Analysis is done for 2010-11 (T0) period (*Batch -1*) projects taking 2018-19 (T5) period satellite images



- 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.

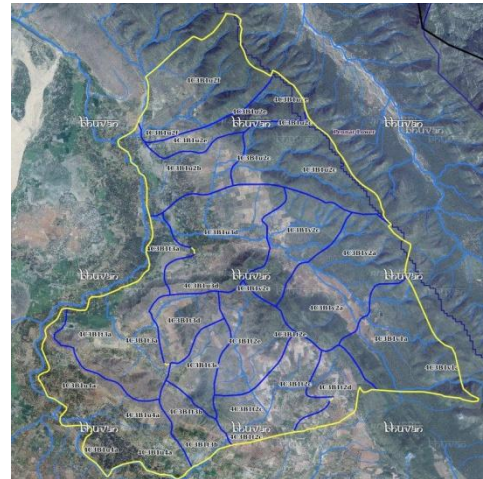
## Satellite Data and Ancillary Data

| Satellite data* | T0-A**  | T0-B**  | T5        |
|-----------------|---------|---------|-----------|
|                 | 2010-11 | 2011-12 | 2018-19   |
| LISS IV         | 2010-11 |         |           |
| SCENE 1         |         |         | 21-Dec-14 |
| SCENE2          |         |         |           |
| SCENE 3         |         |         |           |
| SCENE 4         |         |         |           |
| CARTO           | 2010-11 |         |           |
| SCENE 1         |         |         | 21-Dec-14 |
| 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        | 210    |
| 4 | Detailed Project Report |              |        |

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



### Legend



Drainage (1:10000 Scale)

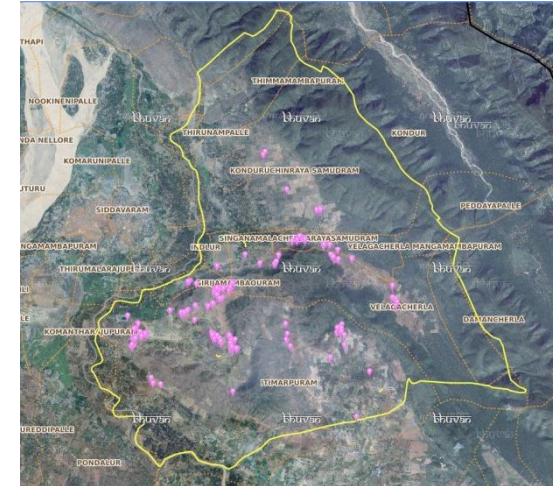


MWS Boundary



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      | Agronomic measures  | 0             | 0                    |
| 2      | Afforestation   | 21            | 15                   |
| 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  | 8             | 8                    |
| 9      | New activity (boulder removal, farm ponds, dug out pits etc.,)              | 0             | 0                    |
| 10     | Farm ponds/Dug out pit  | 7             | 7                    |
| 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)                                      | 4             | 4                    |
| 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  | 204           | 180                  |
|        | <b>TOTAL</b>  | <b>244</b>    | <b>210</b>           |

## 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 (2010-11) and T5 is 2018-19 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.



Monitoring of activities in YSR Kadapa Dt Andhra Pradesh. IWMP-13/2010-11



T0

T0: 2010-11



T1

T1: 13 May 2014



Drishti Sl no. 1893244

MWS : 4C3B1t3a

Farm pond



T0

T0: 2010-11



T1

T1: 13 May 2014



Drishti Sl no. 2449279

MWS :4C3B1t3a

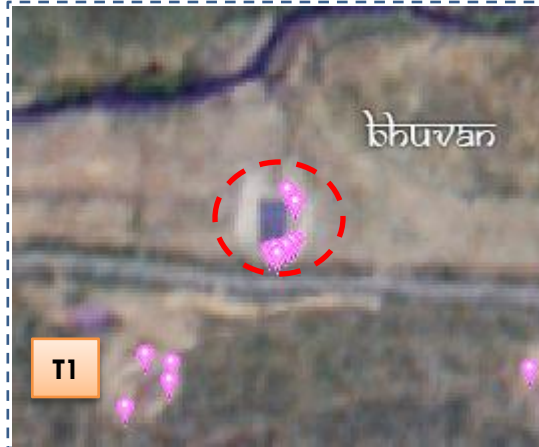
Horticulture



Monitoring of activities in YSR Kadapa Dt Andhra Pradesh. IWMP-13/2010-11



T0: 2010-11

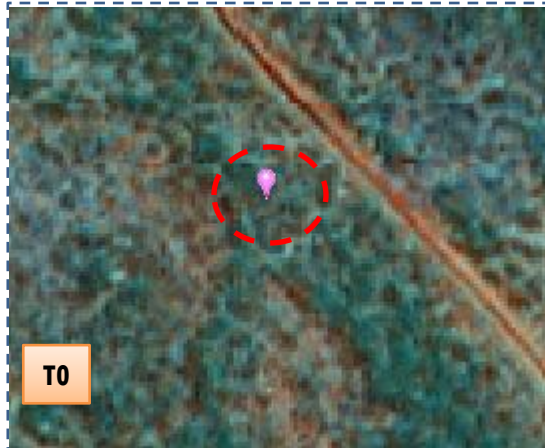


T1: 13 May 2014

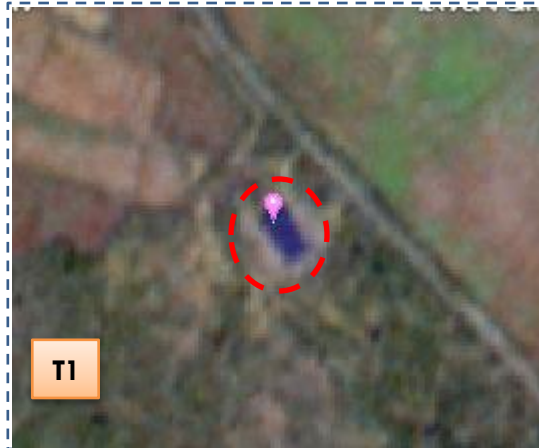


Drishti SI no. \_2250395 MWS :4C3B1u3d

Percolation tank



T0: 2010-11



T1: 13 May 2014



Drishti SI no. 2477035 MWS : 4C3B1t3a

Percolation tank

# Natural Color Composite – 2010-11 to 2018-19

**Natural Color Composite - 2010-11**



Source:Fusen data,NRSC

**Natural Color Composite - 13th May 2014**



Source:LISS-IV,NRSC

**Natural Color Composite - 24th March 2016**



Source:Fusen data,NRSC

**Natural Color Composite - 23rd February 2017**



Source:LISS-IV,NRSC

**Natural Color Composite - 06th March 2018**



Source:LISS-IV,NRSC

**Natural Color Composite - 23rd February 2019**



Source:Sentinel

## MONITORING IN THE PROJECT AREA

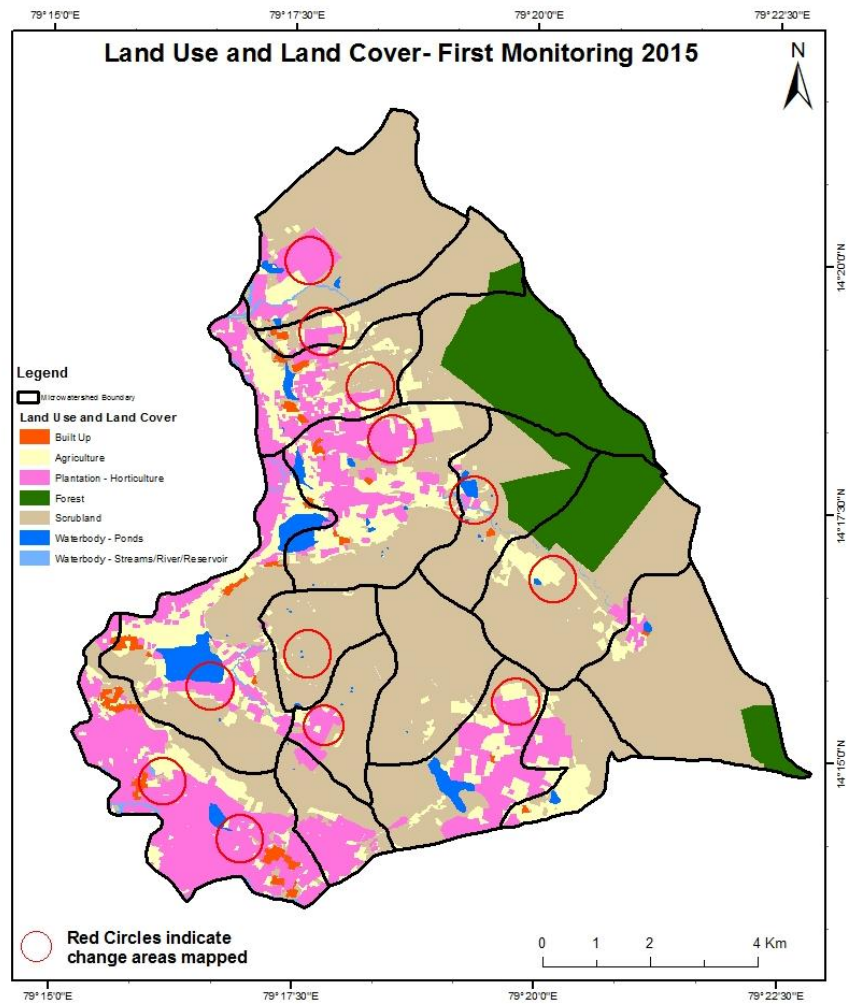
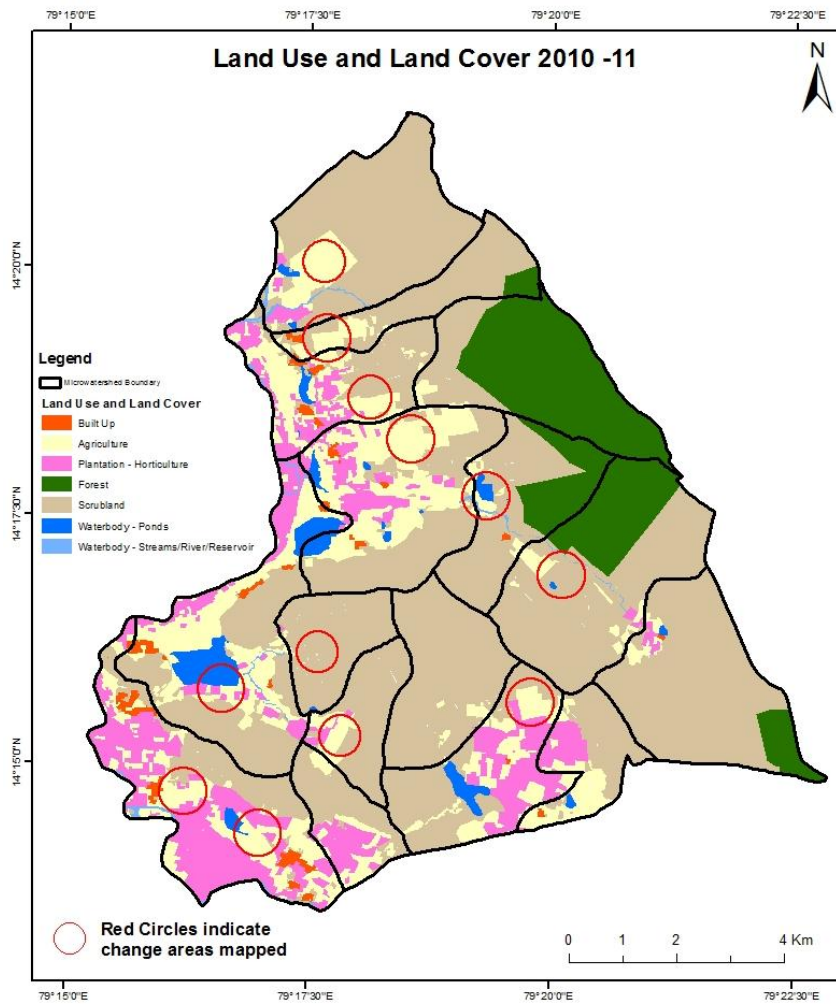
### Land use and Land cover Changes in the Project

- Change in land use and land cover from 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 (2010-11) and row represents the T5 (2018-19)



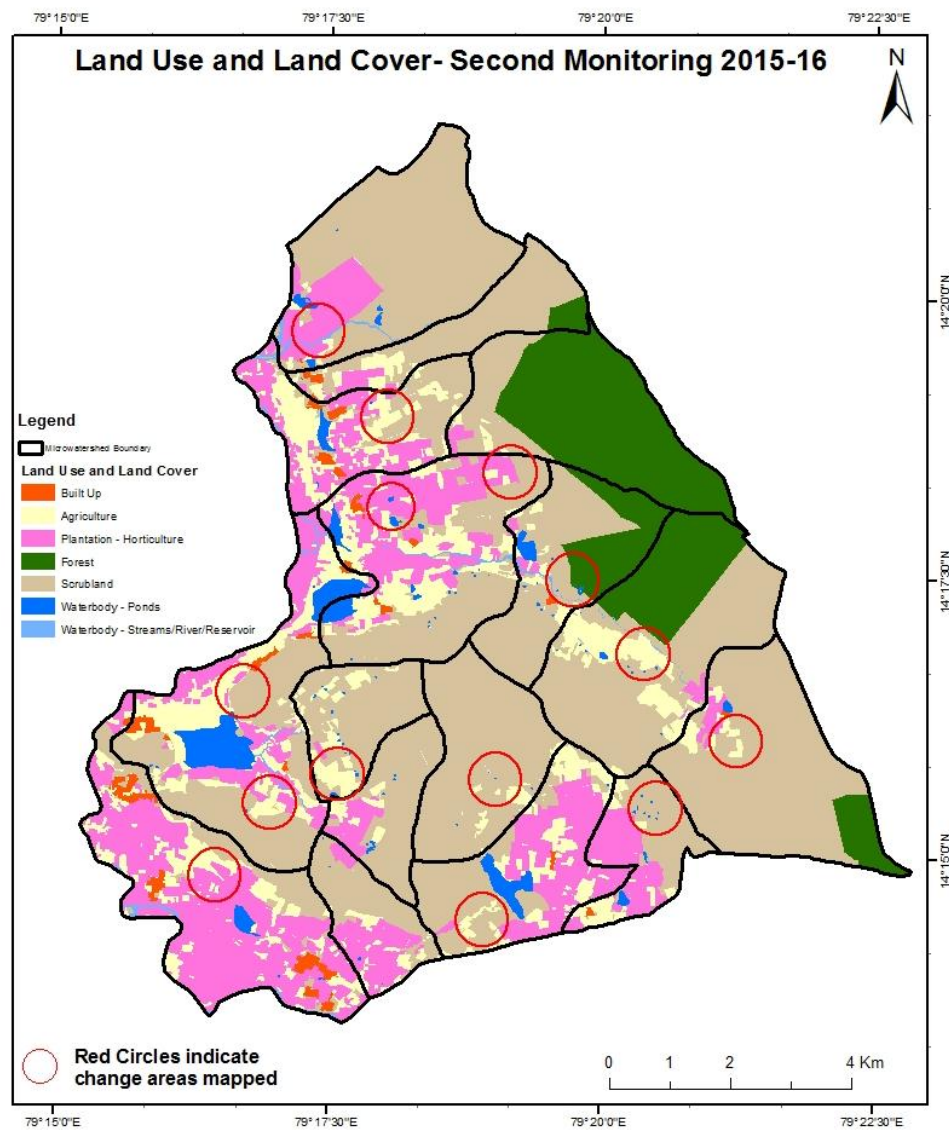
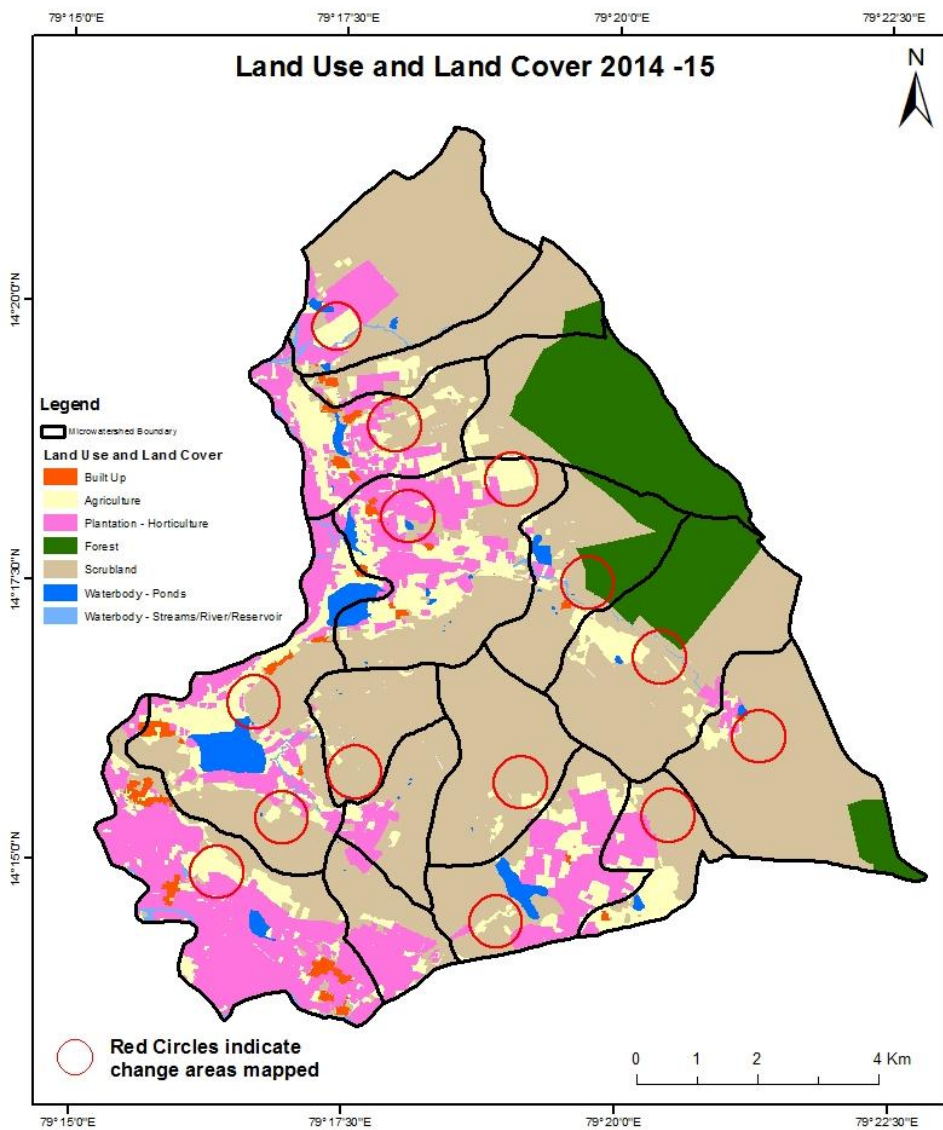
# Comparative assessment of Land Use and Land Cover for Pre and Post IWMP implementation (2010-11 to 2014-15)

Scale: 1:10000



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

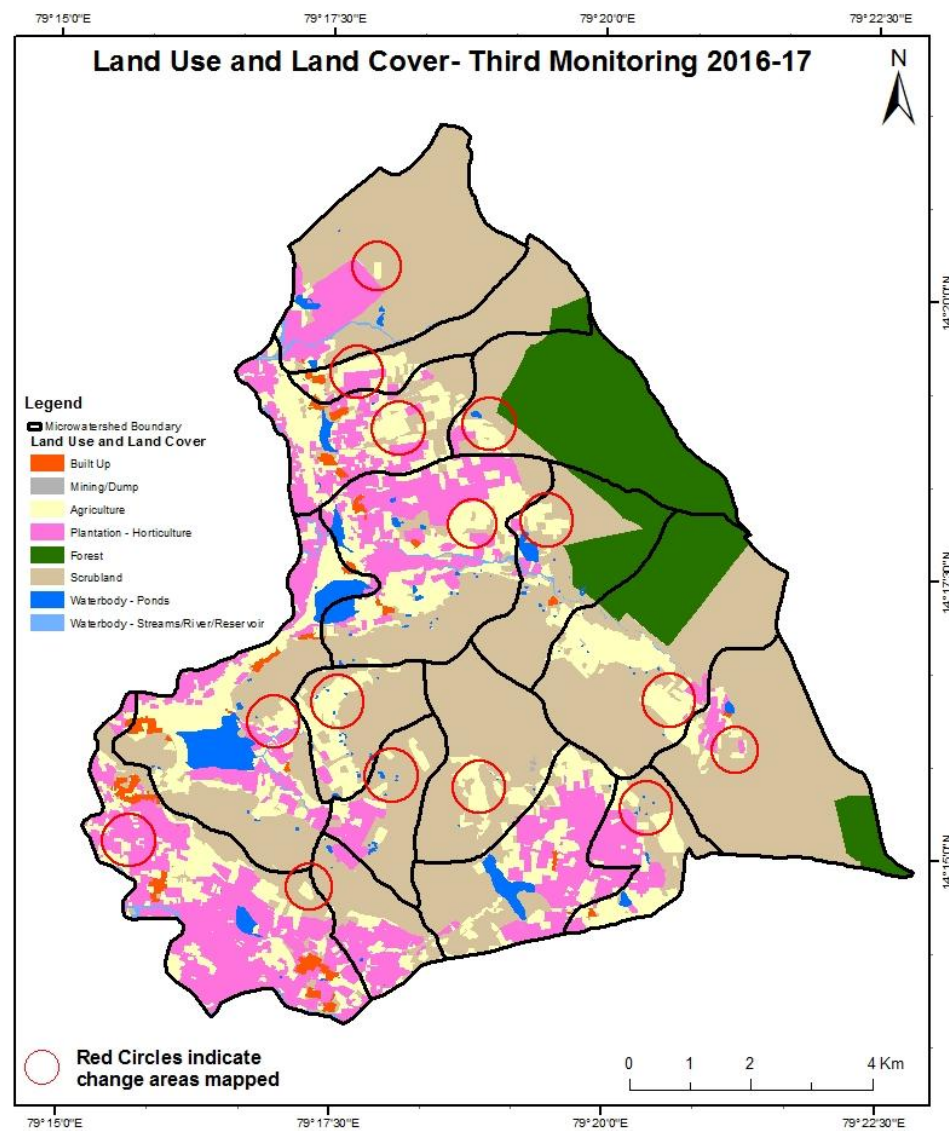
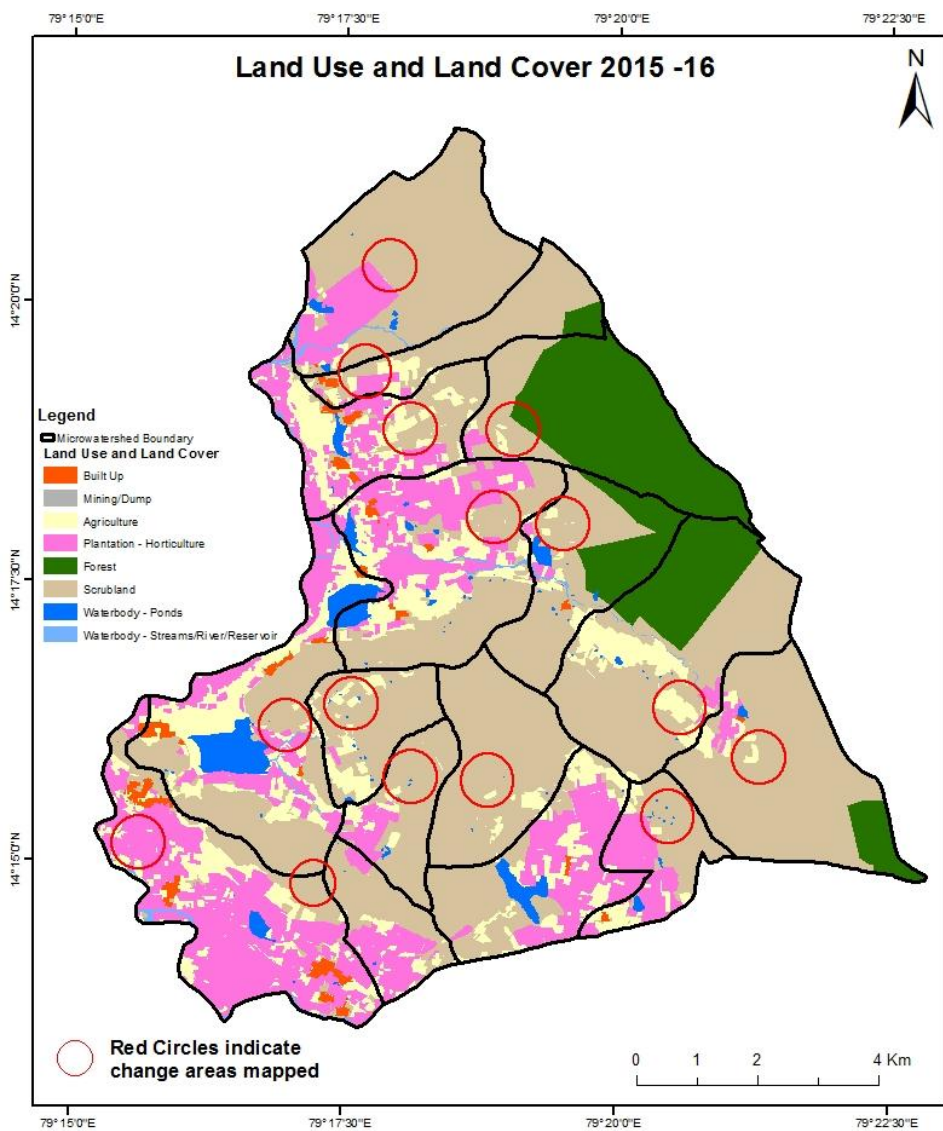
Scale: 1:10000





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

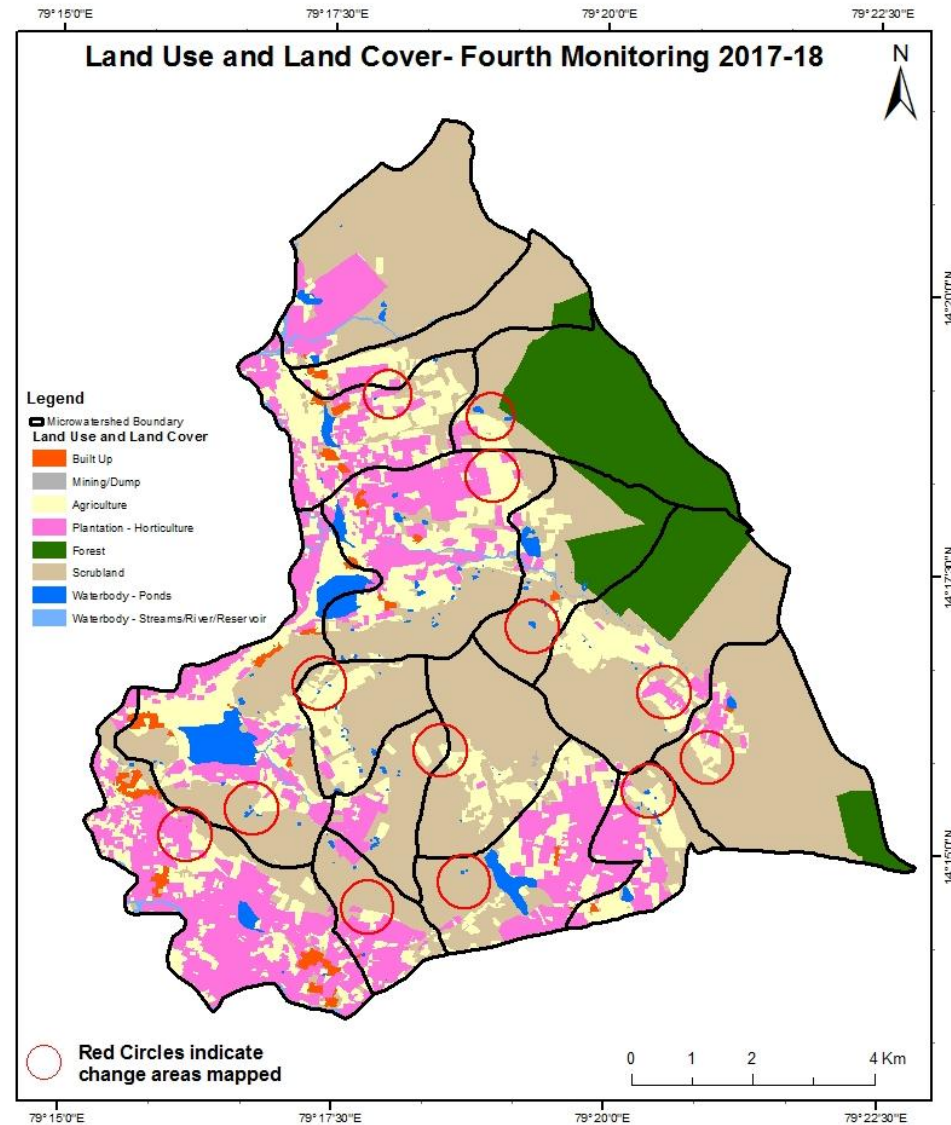
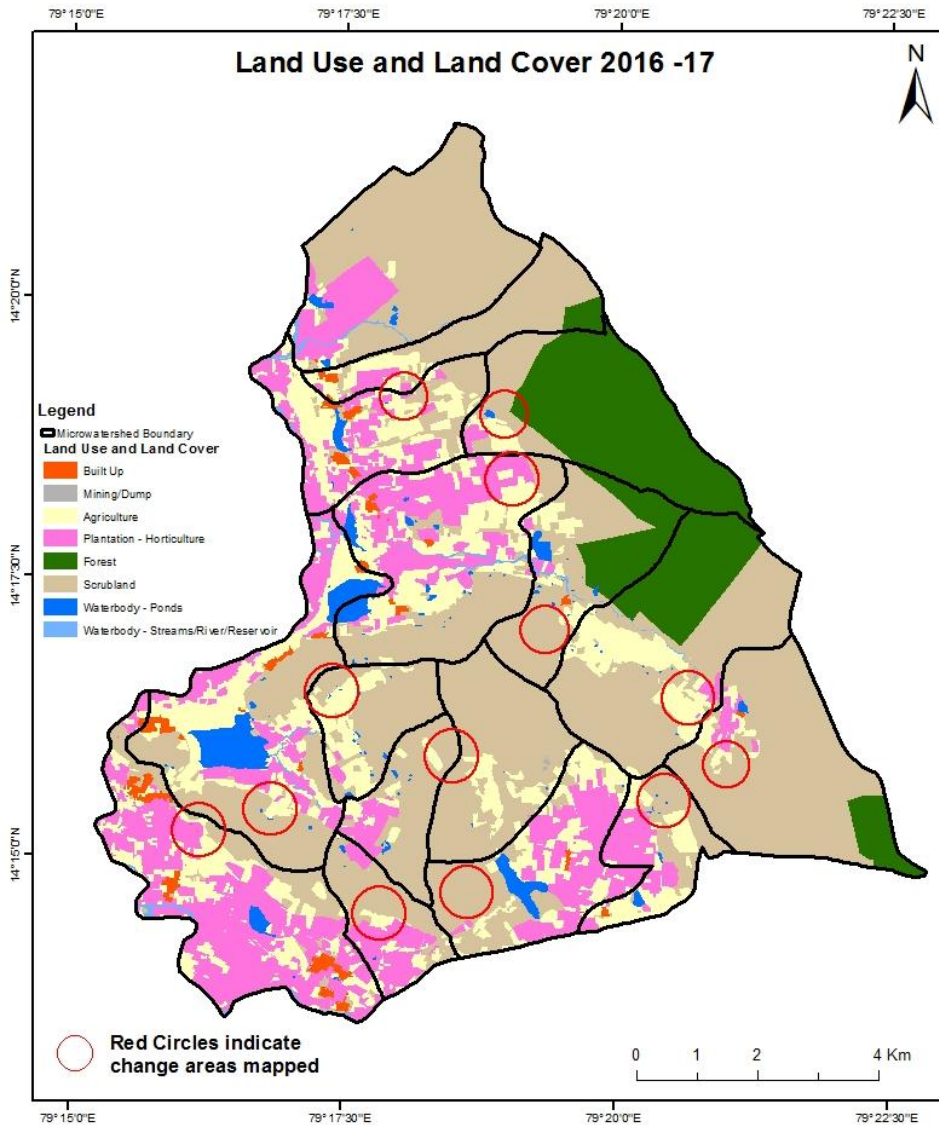
Scale: 1:10000





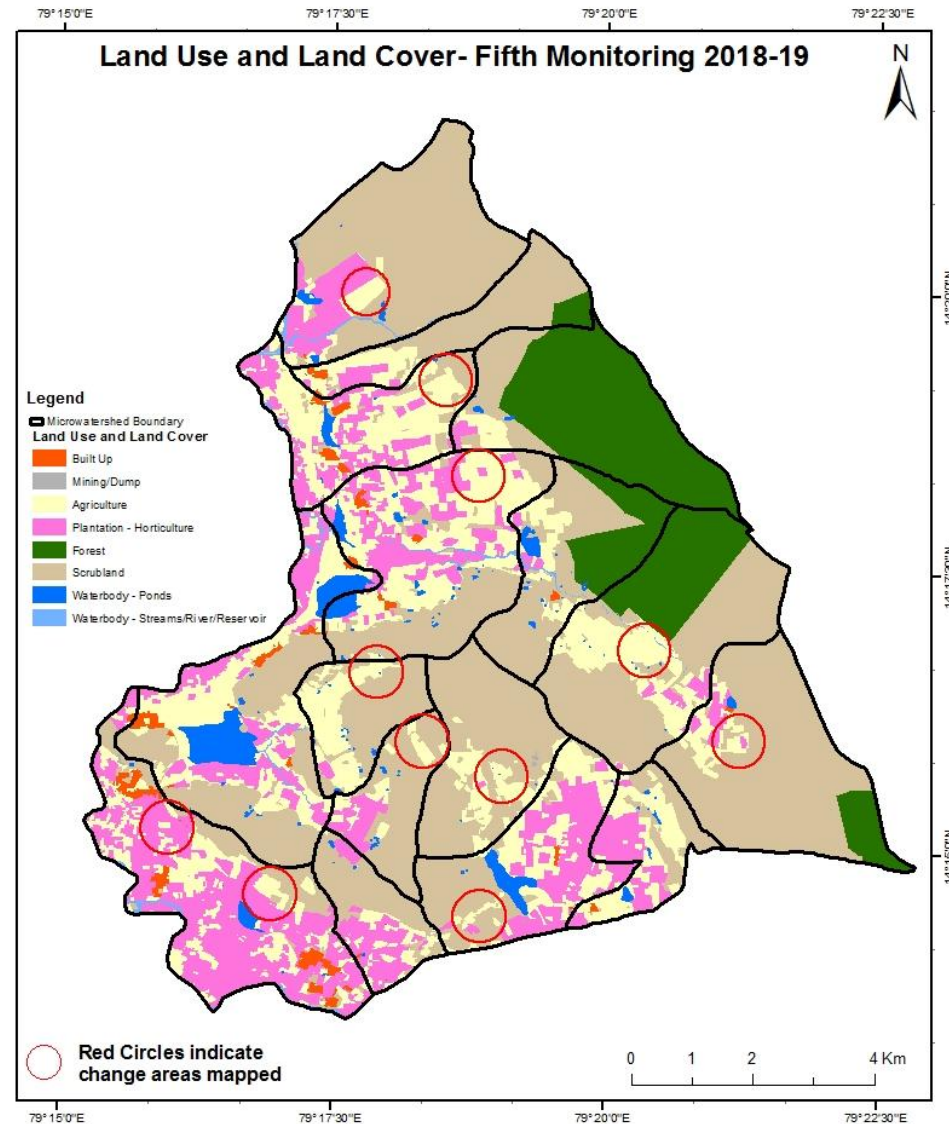
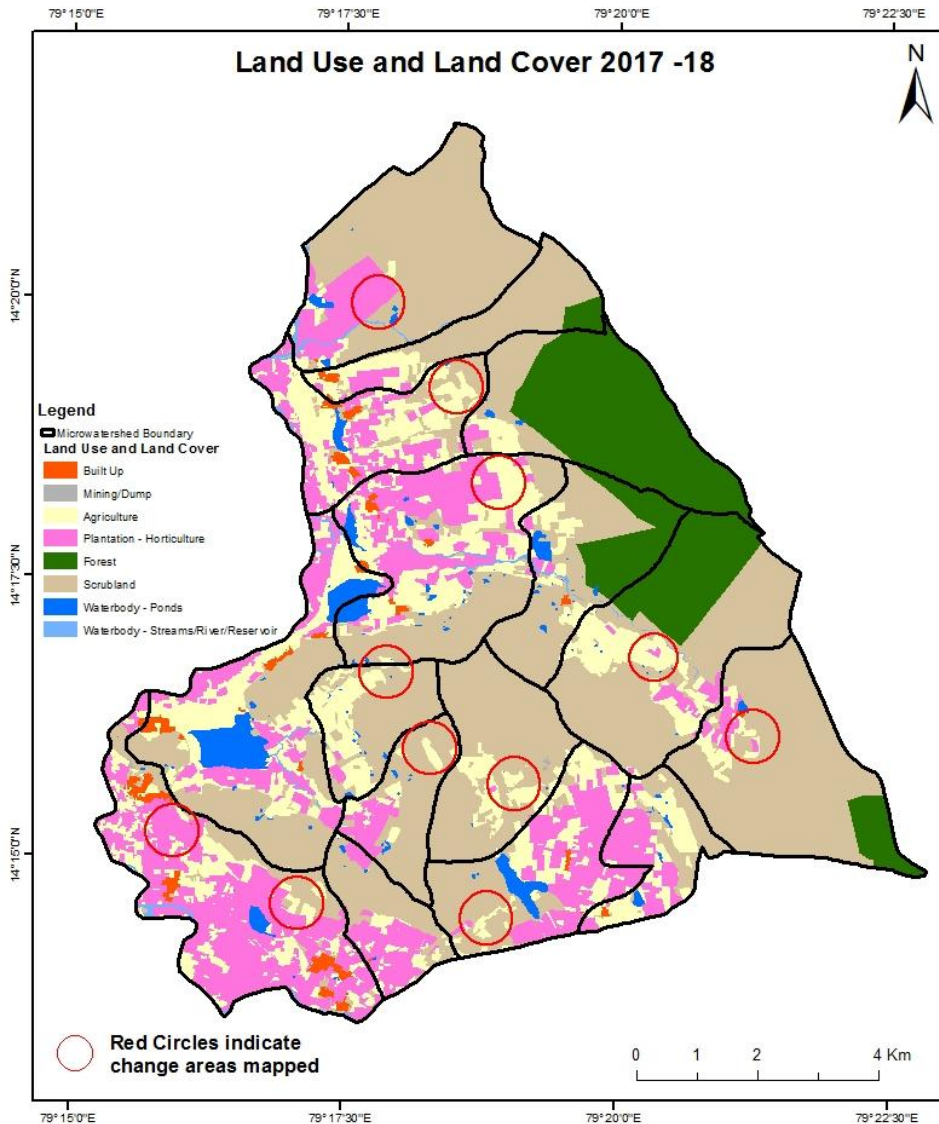
# Comparative assessment of Land Use and Land Cover for Pre and Post IWMP implementation (2016-17 to 2017-18)

Scale: 1:10000



# Comparative assessment of Land Use and Land Cover for Pre and Post IWMP implementation (2017-18 to 2018-19)

Scale: 1:10000

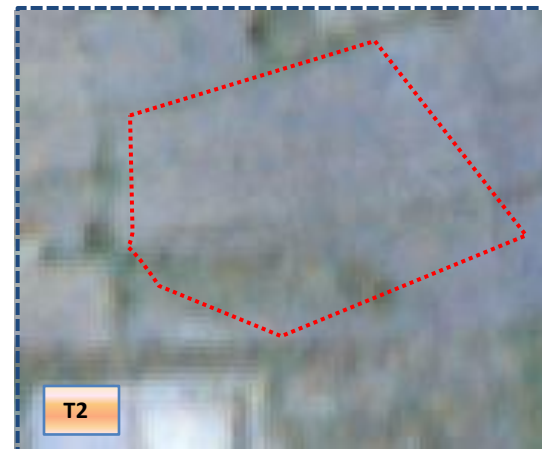


## Land Use and Land Cover changes for Pre and Post treatment dates

### Plantation to Agriculture



T1: 2014-15 (79°18'14.286"E 14°17'13.164"N)

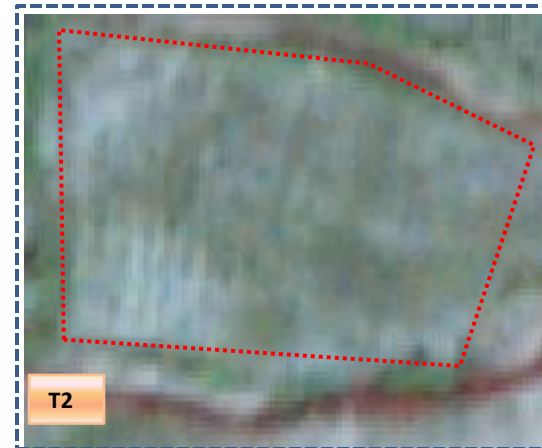


T2: 10 January 2016

### Agriculture to Plantation



T1: 2014-15 (79°18'47.769"E 14°17'39.315"N)

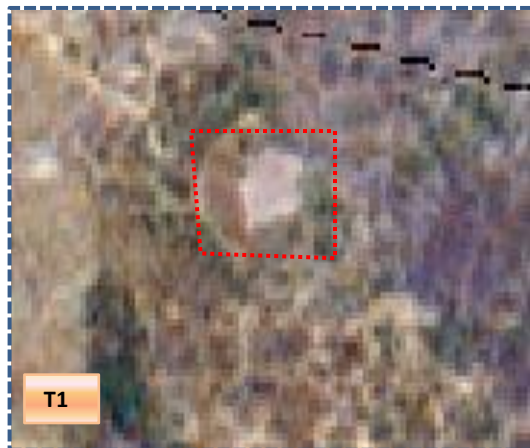


T2: 10 January 2016



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

Scrub to Waterbody



T1: 2014-15 (79°19'32.432"E 14°17'40.406"N )

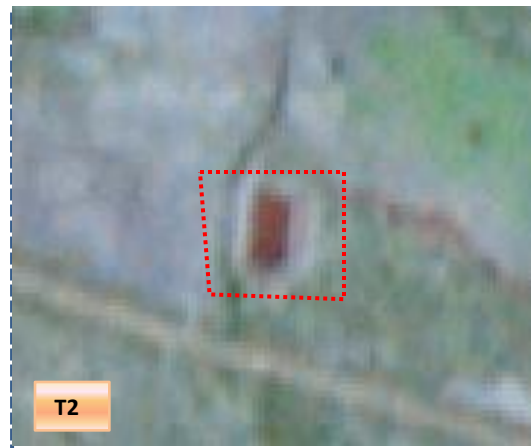


T2: 10 January 2016

Scrub to Waterbody



T1: 2014-15(79°19'24.276"E 14°17'27.176"N)



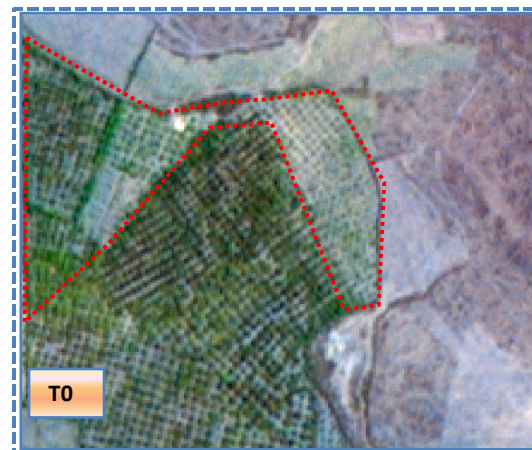
T2: 10 January 2016

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

Agriculture to Plantation



T0: 2010-11



T0: 13 May 2014

Agriculture to Plantation



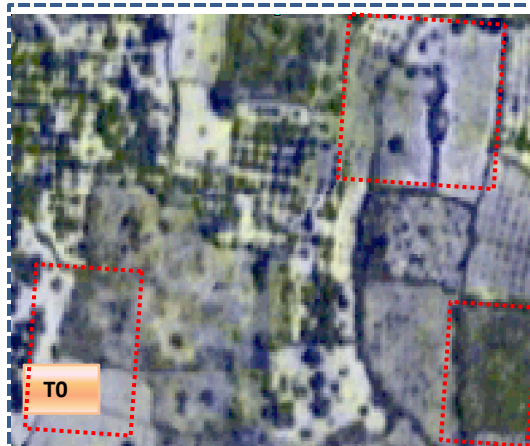
T0: 2010-11



T0: 13 May 2014

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

### Agriculture to Plantation



T0: 2010-11



T1: 13 May 2014

### Agriculture to Built-up



T0: 2010-11



T1: 13 May 2014



**Table showing change matrix depicting Land cover transitions during study period-2010-11 to 2014-15**

| Land cover                  | Monitoring period (T1) |                 |             |                            |         |                      |                 |         |                             |                     | Units in Hectares |
|-----------------------------|------------------------|-----------------|-------------|----------------------------|---------|----------------------|-----------------|---------|-----------------------------|---------------------|-------------------|
| T0                          | Built up               | Mining/<br>dump | Agriculture | Plantation<br>Horticulture | Forest  | Forest<br>Plantation | Barren<br>Rocky | Scrub   | Waterbody-<br>Streams/River | Water body<br>Ponds | Grand Total       |
| Built up                    | 99.00                  |                 |             |                            |         |                      |                 |         |                             |                     | 99.00             |
| Mining/dump                 |                        |                 |             |                            |         |                      |                 |         |                             |                     |                   |
| Agriculture                 | 4.16                   |                 | 1051.51     | 753.24                     |         |                      |                 | 1.73    | 1.21                        | 0.67                | 1812.53           |
| Plantation<br>Horticulture  | 1.25                   |                 | 3.49        | 1149.16                    |         |                      |                 |         |                             |                     | 1153.91           |
| Forest                      |                        |                 |             |                            | 1180.06 |                      |                 |         |                             |                     | 1180.06           |
| Forest<br>Plantation        |                        |                 |             |                            |         |                      |                 |         |                             |                     |                   |
| Barren Rocky                |                        |                 |             |                            |         |                      |                 |         |                             |                     |                   |
| Scrub                       | 1.78                   |                 | 178.42      | 7.87                       |         |                      |                 | 5795.94 | 1.10                        | 4.75                | 5989.86           |
| Waterbody-<br>Streams/River |                        |                 |             |                            |         |                      |                 |         | 53.25                       |                     | 53.25             |
| Waterbody –<br>Ponds        | 0.45                   |                 | 6.60        | 0.25                       |         |                      |                 |         |                             | 211.82              | 219.11            |
| Grand Total                 | 106.65                 |                 | 1240.02     | 1910.51                    | 1180.06 |                      |                 | 5797.67 | 55.57                       | 217.24              | 10507.72          |

- 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 759 ha of the agriculture area has decreased and it is converted into Built-up, plantation, scrubland and water body in T1.
- In T1 188 ha of the agriculture area has increased from plantations, scrubland and water body of T0.
- The additional agriculture are coming from waterbody in T1 represents seasonal agriculture.

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

| Land cover                  | Monitoring period (T2) |                 |             |                            |         |                      |                 |         |                             |                     | Units in Hectares |
|-----------------------------|------------------------|-----------------|-------------|----------------------------|---------|----------------------|-----------------|---------|-----------------------------|---------------------|-------------------|
|                             |                        | Mining/<br>dump |             | Plantation<br>Horticulture | Forest  | Forest<br>Plantation | Barren<br>Rocky | Scrub   | Waterbody-<br>Streams/River | Water body<br>Ponds | Grand Total       |
| T1                          | Built up               |                 | Agriculture |                            |         |                      |                 |         |                             |                     |                   |
| Built up                    | 106.65                 |                 |             |                            |         |                      |                 |         |                             |                     | 106.65            |
| Mining/dump                 |                        |                 |             |                            |         |                      |                 |         |                             |                     |                   |
| Agriculture                 | 1.15                   |                 | 974.93      | 242.71                     |         |                      |                 | 8.44    | 5.55                        | 7.25                | 1240.02           |
| Plantation<br>Horticulture  | 0.46                   | 0.16            | 104.41      | 1803.81                    |         |                      |                 |         |                             | 1.67                | 1910.51           |
| Forest                      |                        |                 |             |                            | 1179.50 |                      |                 |         |                             | 0.55                | 1180.06           |
| Forest<br>Plantation        |                        |                 |             |                            |         |                      |                 |         |                             |                     |                   |
| Barren Rocky                |                        |                 |             |                            |         |                      |                 |         |                             |                     |                   |
| Scrub                       |                        |                 | 272.33      | 1.68                       |         |                      |                 | 5512.45 |                             | 11.20               | 5797.67           |
| Waterbody-<br>Streams/River |                        |                 |             | 1.21                       |         |                      |                 |         | 54.36                       |                     | 55.57             |
| Waterbody –<br>Ponds        |                        |                 | 1.16        |                            |         |                      |                 |         |                             | 216.09              | 217.24            |
| Grand Total                 | 108.25                 | 0.16            | 1352.83     | 2049.41                    | 1179.50 |                      |                 | 5520.89 | 59.90                       | 236.76              | 10507.72          |

- 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 259 ha of the agriculture area has decreased and it is converted into Built-up, plantation, scrubland and water body in T2.
- In T2 377 ha of the agriculture area has increased from plantations, scrubland, and water body of T1. The additional agriculture are coming from waterbody in T2 represents seasonal agriculture.

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

| Land cover                  | Monitoring period (T3) |                 |             |                            |         |                      |                 |         |                             |                     | Units in Hectares |
|-----------------------------|------------------------|-----------------|-------------|----------------------------|---------|----------------------|-----------------|---------|-----------------------------|---------------------|-------------------|
|                             |                        | Mining/<br>dump |             | Plantation<br>Horticulture | Forest  | Forest<br>Plantation | Barren<br>Rocky | Scrub   | Waterbody-<br>Streams/River | Water body<br>Ponds | Grand Total       |
| T2                          | Built up               |                 | Agriculture |                            |         |                      |                 |         |                             |                     |                   |
| Built up                    | 108.25                 |                 |             |                            |         |                      |                 |         |                             |                     | 108.25            |
| Mining/dump                 |                        | 0.16            |             |                            |         |                      |                 |         |                             |                     | 0.16              |
| Agriculture                 | 0.95                   |                 | 1328.41     | 19.08                      |         |                      |                 | 3.34    | 0.53                        | 0.52                | 1352.83           |
| Plantation<br>Horticulture  | 0.57                   |                 | 163.01      | 1885.84                    |         |                      |                 |         |                             |                     | 2049.41           |
| Forest                      |                        |                 |             |                            | 1179.50 |                      |                 |         |                             |                     | 1179.50           |
| Forest<br>Plantation        |                        |                 |             |                            |         |                      |                 |         |                             |                     |                   |
| Barren Rocky                |                        |                 |             |                            |         |                      |                 |         |                             |                     |                   |
| Scrub                       |                        | 1.36            | 407.20      | 2.54                       |         |                      |                 | 5100.90 |                             | 8.88                | 5520.89           |
| Waterbody-<br>Streams/River |                        |                 | 0.16        |                            |         |                      |                 |         | 59.74                       |                     | 59.90             |
| Waterbody –<br>Ponds        |                        |                 | 5.27        |                            |         |                      |                 |         |                             | 231.49              | 236.76            |
| Grand Total                 | 109.77                 | 1.53            | 1904.06     | 1907.45                    | 1179.50 |                      |                 | 5104.25 | 60.27                       | 240.88              | 10507.72          |

- 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 23 ha of the agriculture area has decreased and it is converted into Built-up , plantations, scrubland and water body in T3.
- In T3 575 ha of the agriculture area has increased from plantations, scrubland and water body of T2.
- The additional agriculture are coming from waterbody in T3 represents seasonal agriculture.

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

| Land cover                  | Monitoring period (T4) |                 |             |                            |         |                      |                 |         |                             |                     | Units in Hectares |
|-----------------------------|------------------------|-----------------|-------------|----------------------------|---------|----------------------|-----------------|---------|-----------------------------|---------------------|-------------------|
| T3                          | Built up               | Mining/<br>dump | Agriculture | Plantation<br>Horticulture | Forest  | Forest<br>Plantation | Barren<br>Rocky | Scrub   | Waterbody-<br>Streams/River | Water body<br>Ponds | Grand Total       |
| Built up                    | 109.77                 |                 |             |                            |         |                      |                 |         |                             |                     | 109.77            |
| Mining/dump                 |                        | 1.53            |             |                            |         |                      |                 |         |                             |                     | 1.53              |
| Agriculture                 | 0.22                   |                 | 1741.52     | 154.72                     |         |                      |                 | 6.36    |                             | 1.24                | 1904.06           |
| Plantation<br>Horticulture  | 0.43                   |                 | 67.33       | 1839.69                    |         |                      |                 |         |                             |                     | 1907.45           |
| Forest                      |                        |                 |             |                            | 1179.32 |                      |                 |         |                             | 0.19                | 1179.50           |
| Forest<br>Plantation        |                        |                 |             |                            |         |                      |                 |         |                             |                     |                   |
| Barren Rocky                |                        |                 |             |                            |         |                      |                 |         |                             |                     |                   |
| Scrub                       | 0.46                   | 0.97            | 121.30      |                            |         |                      |                 | 4972.13 | 1.14                        | 8.23                | 5104.25           |
| Waterbody-<br>Streams/River |                        |                 |             |                            |         |                      |                 |         | 60.27                       |                     | 60.27             |
| Waterbody –<br>Ponds        |                        |                 | 0.24        |                            |         |                      |                 |         |                             | 240.64              | 240.88            |
| Grand Total                 | 110.89                 | 2.50            | 1930.39     | 1994.41                    | 1179.32 |                      |                 | 4978.49 | 61.42                       | 250.30              | 10507.72          |

- 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 162 ha of the agriculture area has decreased and it is converted into Built-up, plantations, scrubland and water body in T4.
- In T4 23 ha of the agriculture area has increased from plantations, scrubland and water body of T3.
- The additional agriculture are coming from waterbody in T4 represents seasonal agriculture.

**Table showing change matrix depicting Land cover transitions during study period-2017-18 to 2018-19**

| Land cover                  | Monitoring period (T5) |                 |             |                            |         |                      |                 |         |                             |                     | Units in Hectares |
|-----------------------------|------------------------|-----------------|-------------|----------------------------|---------|----------------------|-----------------|---------|-----------------------------|---------------------|-------------------|
| T4                          | Built up               | Mining/<br>dump | Agriculture | Plantation<br>Horticulture | Forest  | Forest<br>Plantation | Barren<br>Rocky | Scrub   | Waterbody-<br>Streams/River | Water body<br>Ponds | Grand Total       |
| Built up                    | 110.89                 |                 |             |                            |         |                      |                 |         |                             |                     | 110.89            |
| Mining/dump                 |                        | 2.50            |             |                            |         |                      |                 |         |                             |                     | 2.50              |
| Agriculture                 | 0.30                   |                 | 1927.53     | 2.48                       |         |                      |                 |         |                             | 0.08                | 1930.39           |
| Plantation<br>Horticulture  | 1.31                   |                 | 200.08      | 1793.02                    |         |                      |                 |         |                             |                     | 1994.41           |
| Forest                      |                        |                 |             |                            | 1179.32 |                      |                 |         |                             |                     | 1179.32           |
| Forest<br>Plantation        |                        |                 |             |                            |         |                      |                 |         |                             |                     |                   |
| Barren Rocky                |                        |                 |             |                            |         |                      |                 |         |                             |                     |                   |
| Scrub                       | 0.46                   |                 | 174.16      |                            |         |                      |                 | 4803.87 |                             |                     | 4978.49           |
| Waterbody-<br>Streams/River |                        |                 |             |                            |         |                      |                 |         | 61.42                       |                     | 61.42             |
| Waterbody –<br>Ponds        |                        |                 | 1.01        |                            |         |                      |                 |         |                             | 249.29              | 250.30            |
| Grand Total                 | 112.95                 | 2.50            | 2302.79     | 1795.51                    | 1179.32 |                      |                 | 4803.87 | 61.42                       | 249.37              | 10507.72          |

- 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 2.86 ha of the agriculture area has decreased and it is converted into Built-up, plantations and water body in T5.
- In T5 375 ha of the agriculture area has increased from plantations, scrubland and water body of T4.
- 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 decrease of 38 Hectares in Reservoir / Tanks area as compared between baseline LU/LC data 2010-11 (T0) & 2018-19 (T5) years.
4. There is an increase of 112, 551, 26 & 371 Hectares From T1 to T2, T2-T3, T3 to T4 & T4-T5 respectively and overall increase of 1061 Hectares in Crop land area as compared between baseline LU/LC data 2010-11 (T0) & 2018-19 (T5) years.
5. There is an increase of 52 ha of the Plantation/Horticulture area has been increased between 2010-11 (T0) & 2018-19 (T5) years.
6. There is a decrease of 1,185 Hectares in Scrubland area as compared between 2010-11 (T0) & 2018-19 (T5) years.
7. Farm ponds (7) is visible on IWMP Bhuvan Srishti portal out of Bhuvan Drishti photo of Farm ponds (7) verified from the portal.