# MONITORING OF IWMP WATERSHED PROJECTS USING GEO-INFORMATION

## SUMMARY REPORT

KURNOOL -01/2009-10
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

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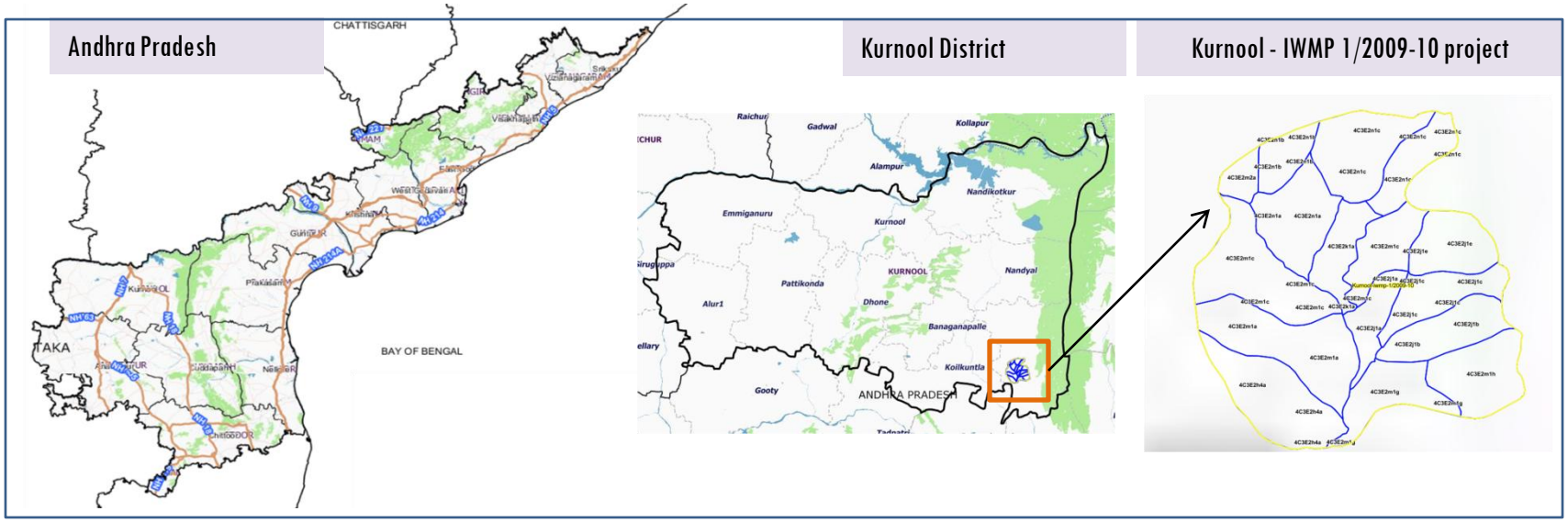
# EXECUTIVE SUMMARY

- 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-01/2009-10, Kurnool District of Andhra Pradesh. The total geographical area of the project is 8,958 ha. It comprises of 16 micro watersheds.
- In the project area 563 Drishti photos were uploaded showing 331 drainage treatment, 47 Farm ponds 20 check dams, 109 New activities like Horticulture, Plantation and remaining showing others.
- Project area as per image analysis has witnessed distinguishable increase in farm ponds, showing 47 new farm ponds or dug out pits with 0.56 ha increase in the area.
- Major percentage i.e. 77.8% is covered by the agriculture, 11.11 % is covered by Scrub land, 2.76 % is covered by forest and remaining by other land use classes.

# PROJECT : KURNOOL - IWMP-01/2009-10
# DISTRICT : KURNOOL , STATE : ANDHRA PRADESH

- The study area falls in Allagadda Mandal of Kurnool district of Andhra Pradesh state. The total geographical area of the project is 8,958 ha. It comprises of 16 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 is tropical with temperatures ranging from 26 °C to 46 °C in the summer and 12 °C to 31 °C in the winter. The average annual rainfall is about 705 millimeters (28 in).
- The average annual rainfall of the district is 665.5mm, which ranges from nil rainfall in January and December to 139.6 mm in September. August and September are the wettest months. The mean seasonal rainfall distribution is 459.1mm in southwest monsoon (June September), 133.7mm in northeast monsoon ( Oct-Dec), 1.9 mm rainfall in Winter (Jan Feb) and 70.8 mm in summer (March–May).

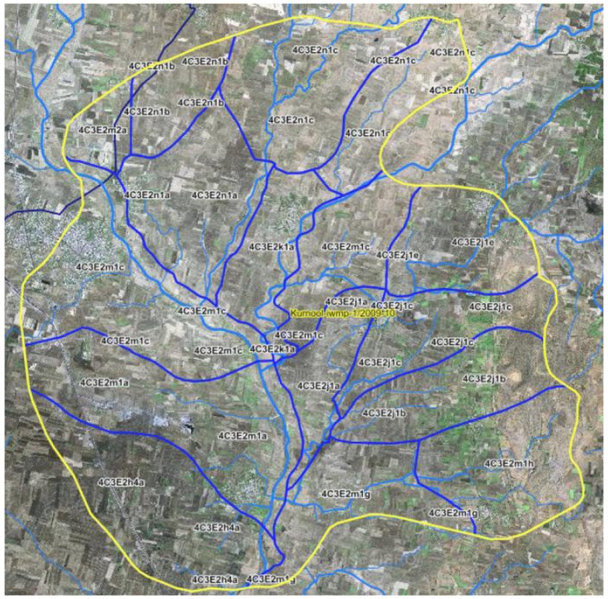
# Satellite Data and Ancillary Data

| Satellite data* | T0-A** | T0-B** | T5 |
|---|---|---|---|
| | 2009-10 | 2011-12 | 2017-18 |
| LISS IV | 2009-10 | | |
| SCENE 1 | | | 9-Dec-17 |
| SCENE2 | | | |
| SCENE 3 | | | |
| SCENE 4 | | | |
| | | | |
| CARTO | 2009-10 | | |
| SCENE 1 | | | 9-Dec-17 |
| 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 | 563 |
| 4 | Detailed Project Report | | |
| | | | |

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



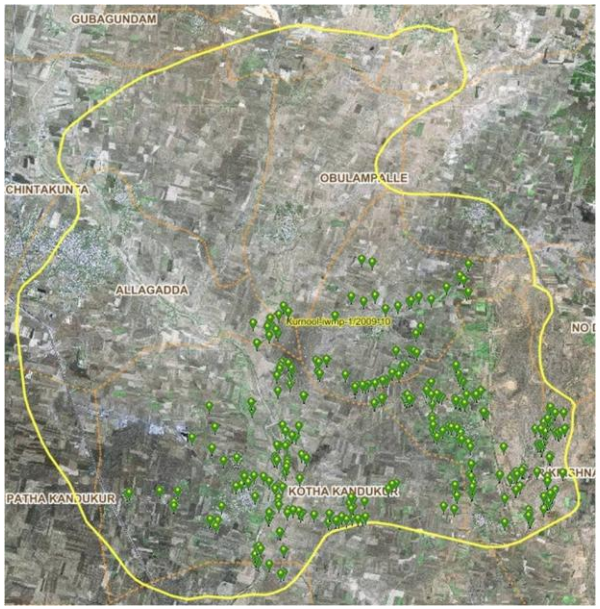
Legend

Drainage (1:10000 Scale)

MWS Boundary

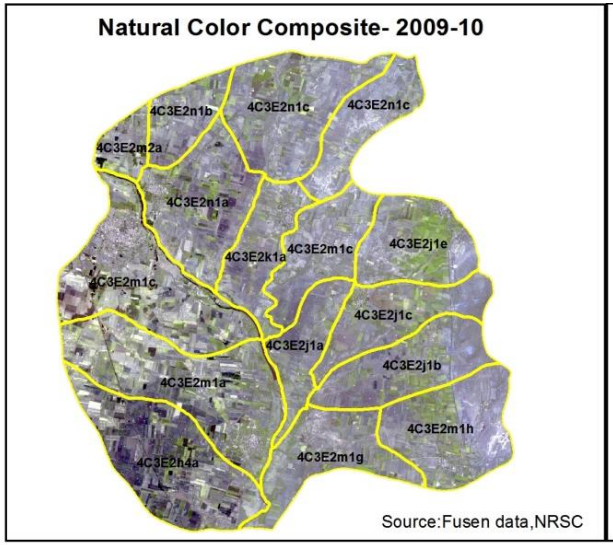
Project Boundary

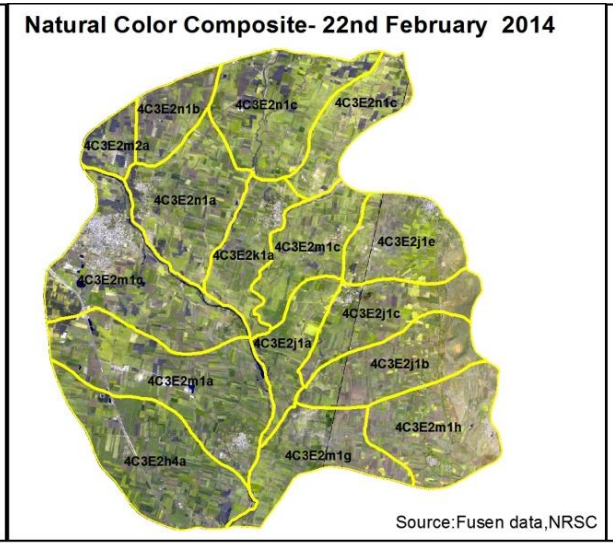
## Natural Color Composite overlaid with Drishti Points

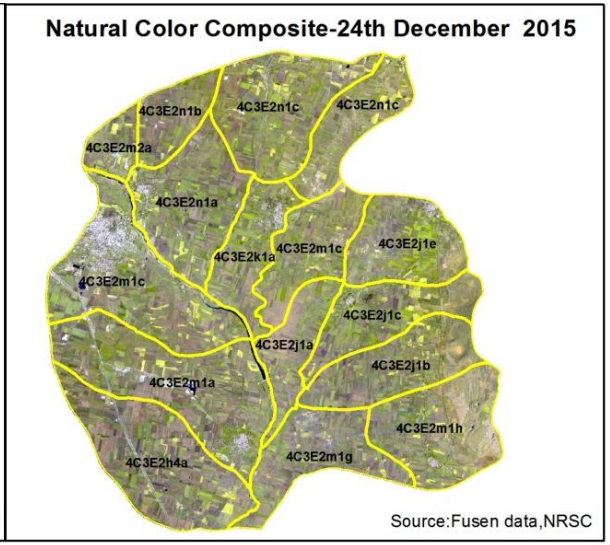


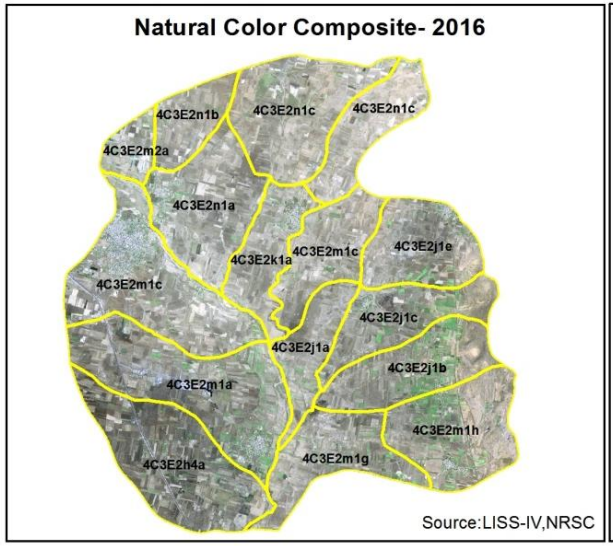

Drishti Upload Status

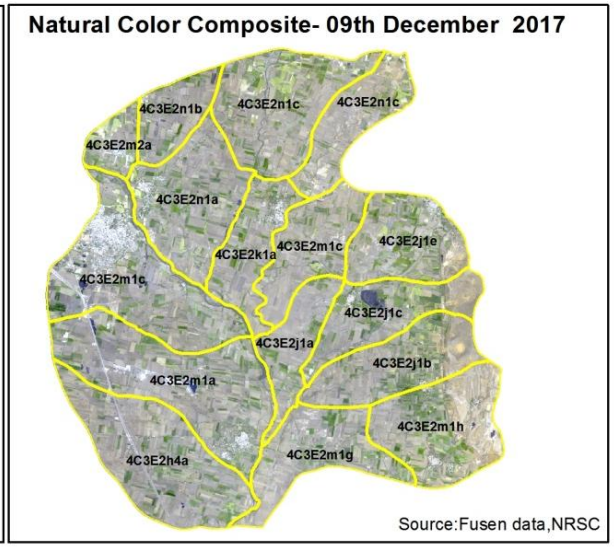
# Natural Color Composite – 2009-10 to 2017-18



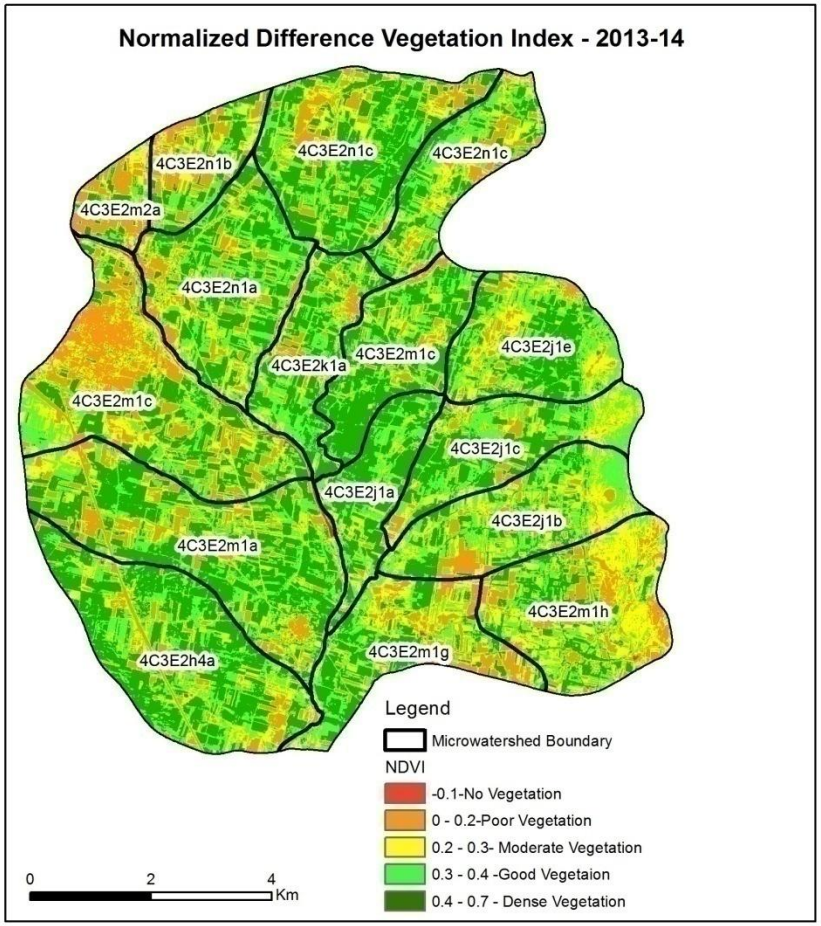



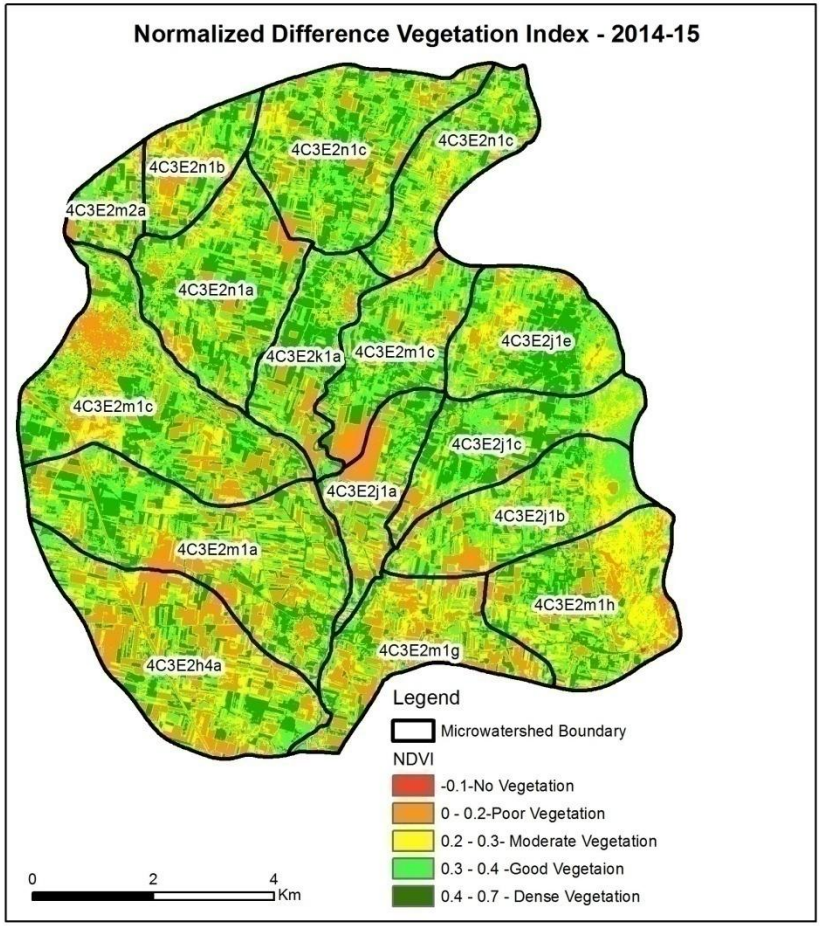



# Changes in Vegetation Cover

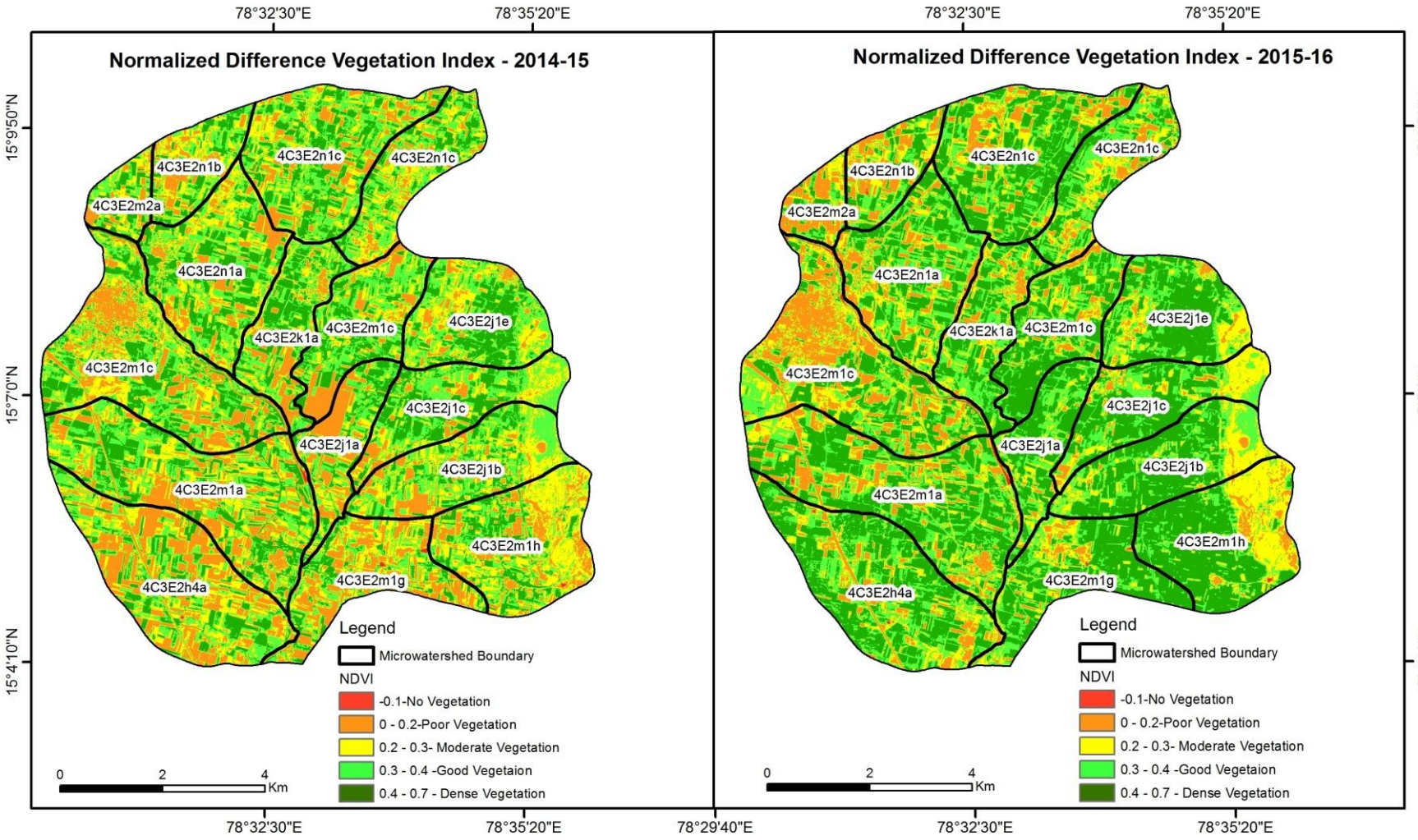



NDVI (2013-14)




NDVI (2014-15)

# Changes in Vegetation Cover




NDVI (2014-15)

NDVI (2015-16)

# Classification of the Activities

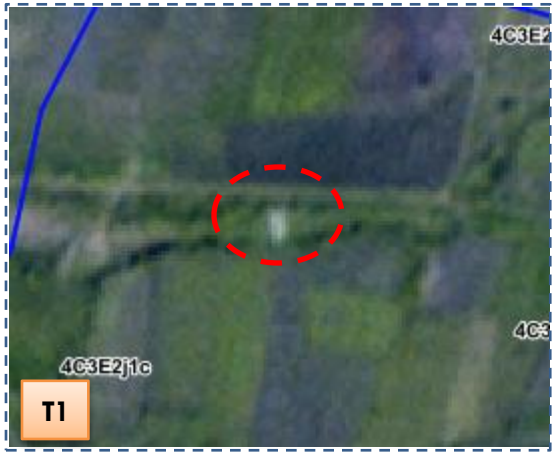
| Sr. No | Activity | Drishti Photo | Visible on satellite |
|---|---|---|---|
| 1 | Afforestation | 0 | 0 |
| 2 | Horticulture | 0 | 0 |
| 3 | Agriculture | 0 | 0 |
| 4 | Blockplanting | 2 | 1 |
| 5 | Bund planting | 1 | 1 |
| 6 | Drainage Treatment | 409 | 331 |
| 7 | Farm ponds/Dug out pit | 47 | 47 |
| 8 | Check dams (Civil work) | 22 | 20 |
| 9 | New Activity | 128 | 109 |
| 10 | Om (Other measurement) | 27 | 20 |
| 11 | LM (Livelihood Measures) | 36 | 34 |
| 12 | Nallah Bunds/Drainage treatment | 0 | 0 |
| 13 | Percolation tanks / Ground water recharge structure | 0 | 0 |
| 14 | Production System and Micro-Enterprises | 0 | 0 |
| 15 | Livelihood Activities | 0 | 0 |
| 16 | Capacity Building Activities | 0 | 0 |
| 17 | Entry Point Activity | 0 | 0 |
| 18 | Others | 0 | 0 |
| | **TOTAL** | **672** | **563** |

# 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.

## Monitoring of activities in Kurnool Dt Andhra Pradesh. IWMP-01/2009-10


T0:2009-10

T1: 22 February 2014

Drishti Sl no. 799687 MWS :4C3E2j1c

**Check dam**


T0:2009-10

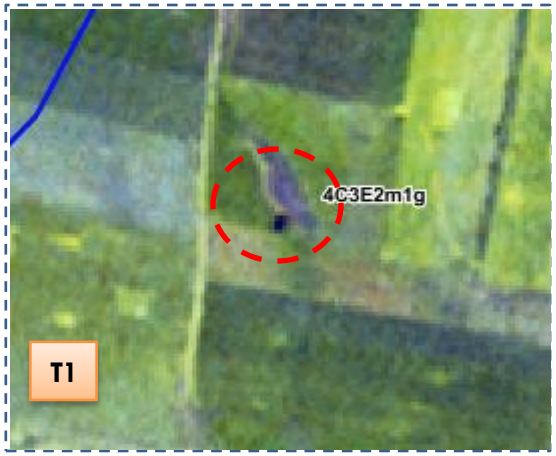
T1: 22 February 2014

Drishti Sl no.709379 MWS : 4C3G5e2a

**Check dam**

# Monitoring of activities in Kurnool Dt Andhra Pradesh. IWMP-01/2009-10

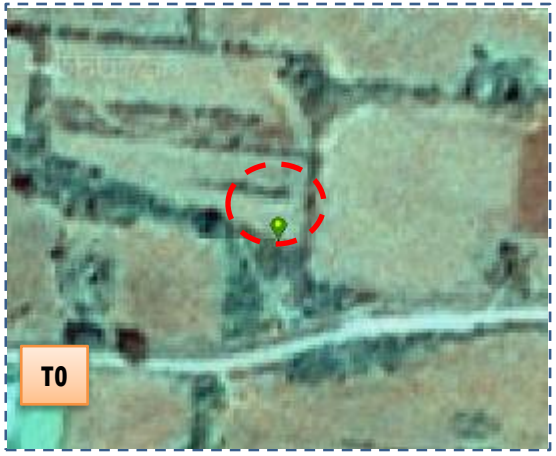

T0: 2009-10




T1: 22 February 2014

Drishti Sl no. 564858 MWS :4C3G5e1b

**Checkdam**



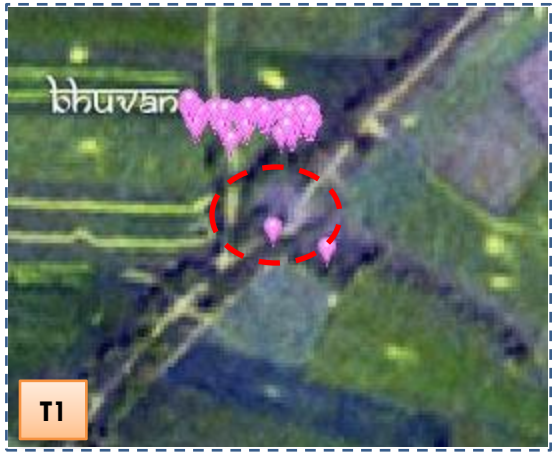

T0: 2009-10


T1: 22 February 2014

Drishti Sl no. 568675 MWS :4C3G5e1c

**Farm pond**

# Monitoring of activities in Kurnool Dt Andhra Pradesh. IWMP-01/2009-10



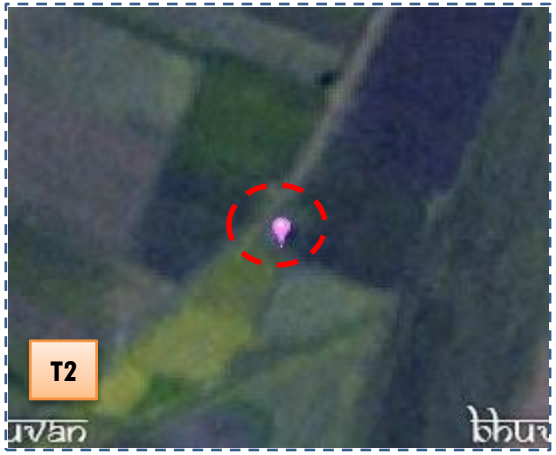

T1:2013


T2: 24 December 2015

Drishti Sl no. 140105 MWS :4C3E2j1c

## Drainage Treatment


T1:2013




T2: 24 December 2015

Drishti Sl no. 52405 MWS : 4C3G5e2a

## Farm pond

## Monitoring of activities in Kurnool Dt Andhra Pradesh. IWMP-01/2009-10


T1: 2013


T2: 24 December 2015

Drishti Sl no. 152400 MWS :4C3G5e1b

**Checkdam**

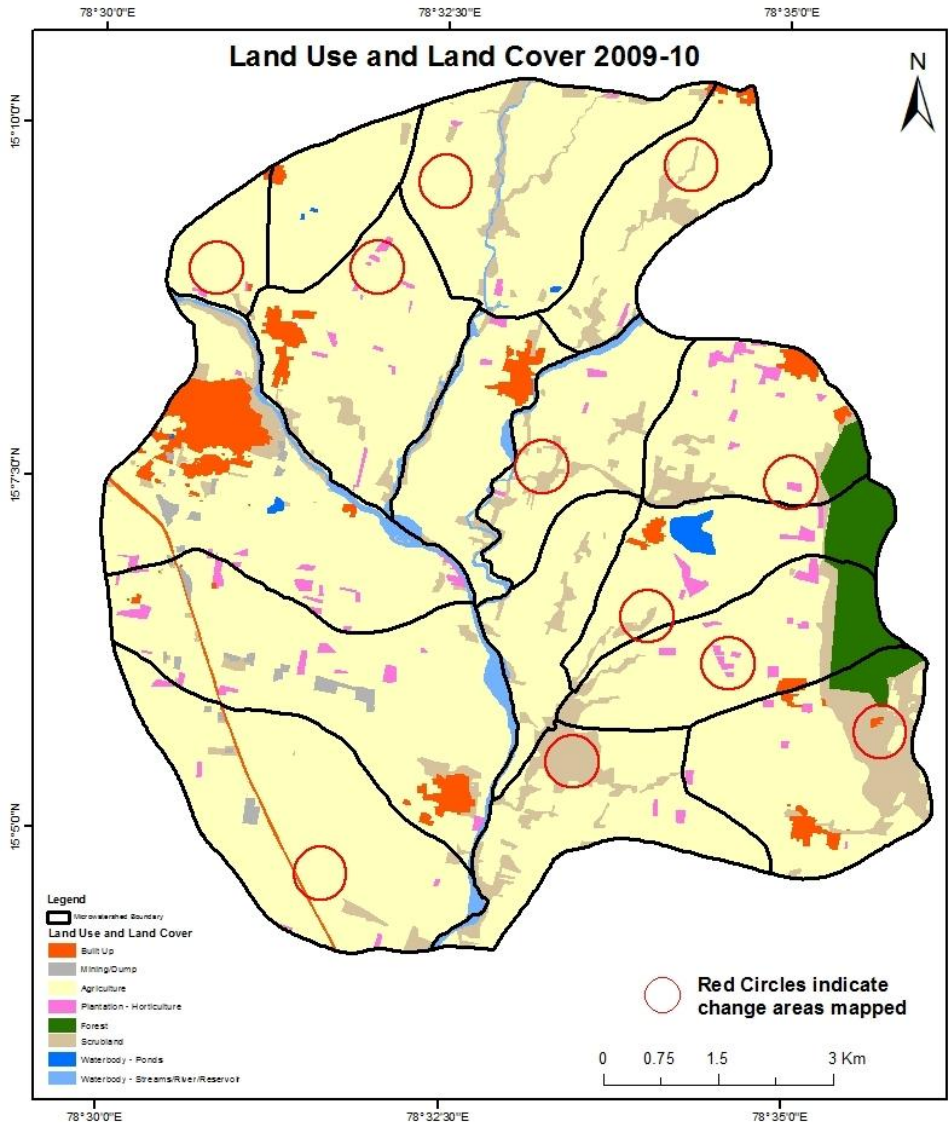
# MONITORING IN THE PROJECT AREA

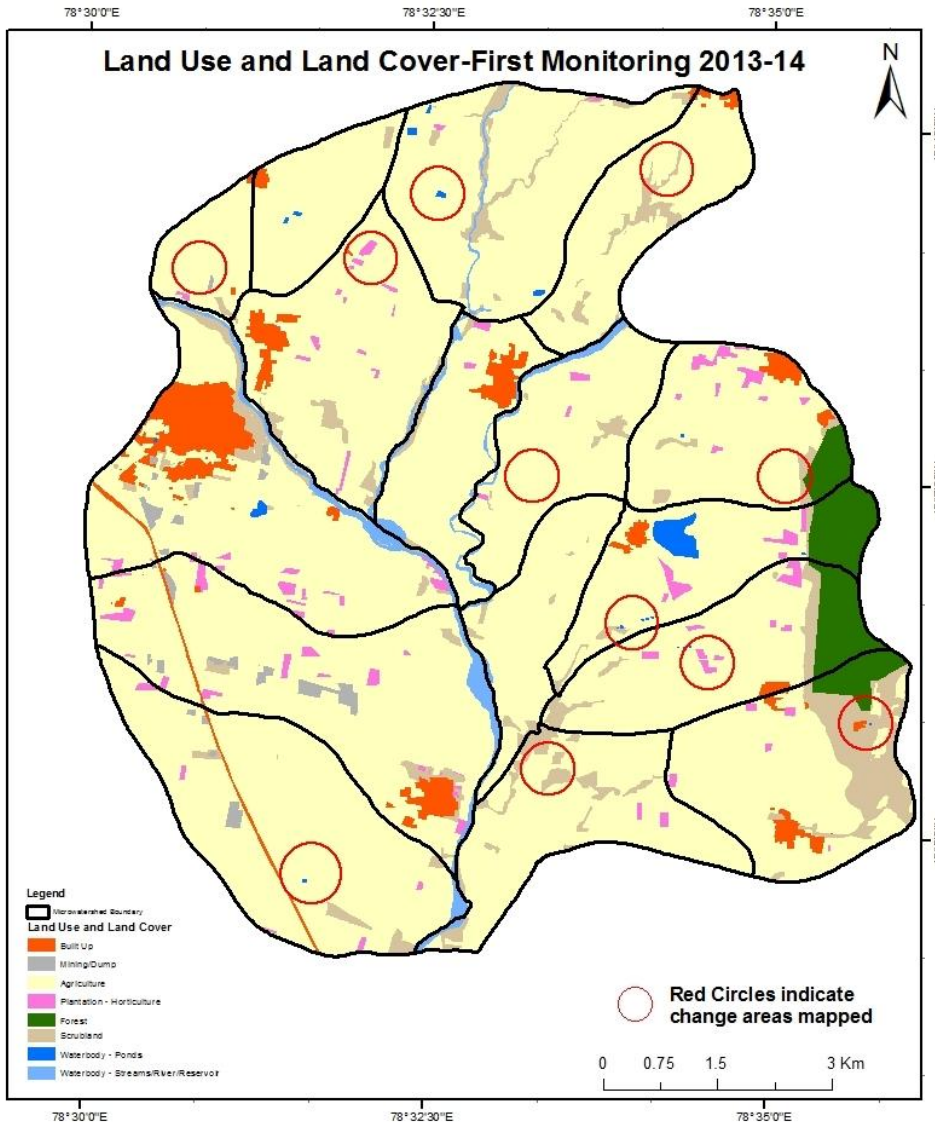
## Land use and Land cover Changes in the Project

- 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)

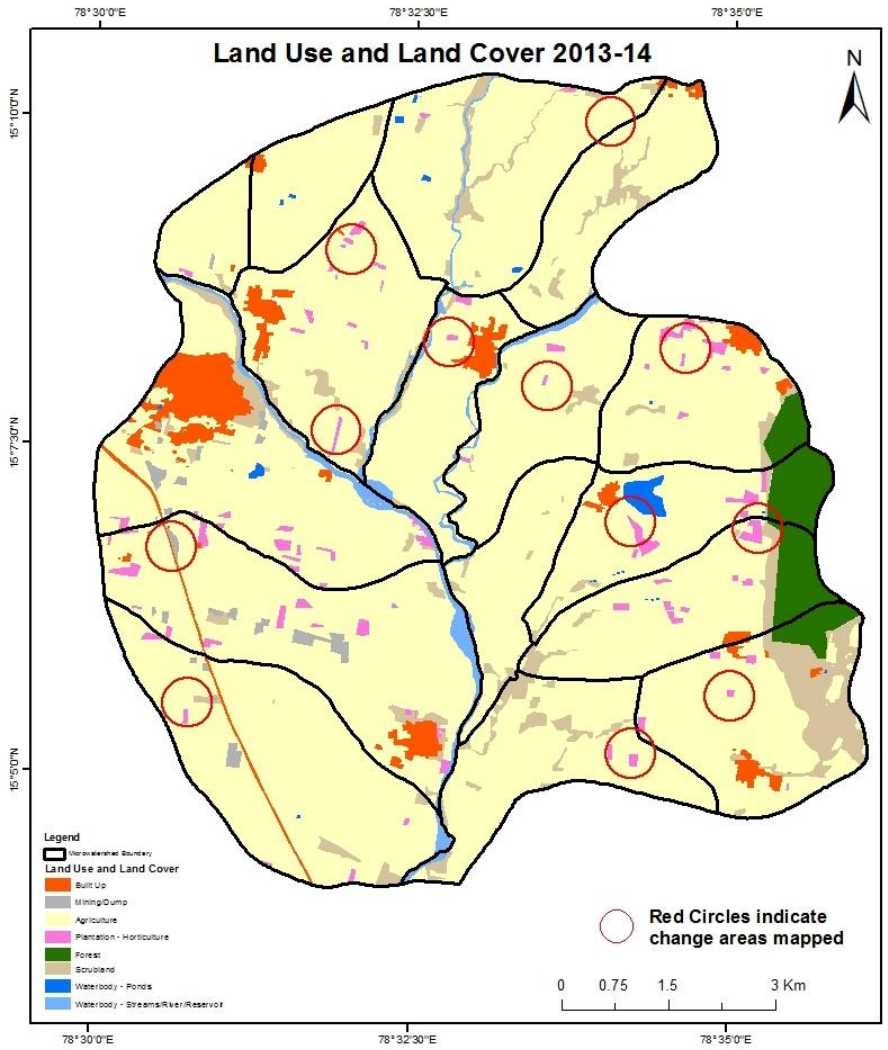
Scale: 1:10000

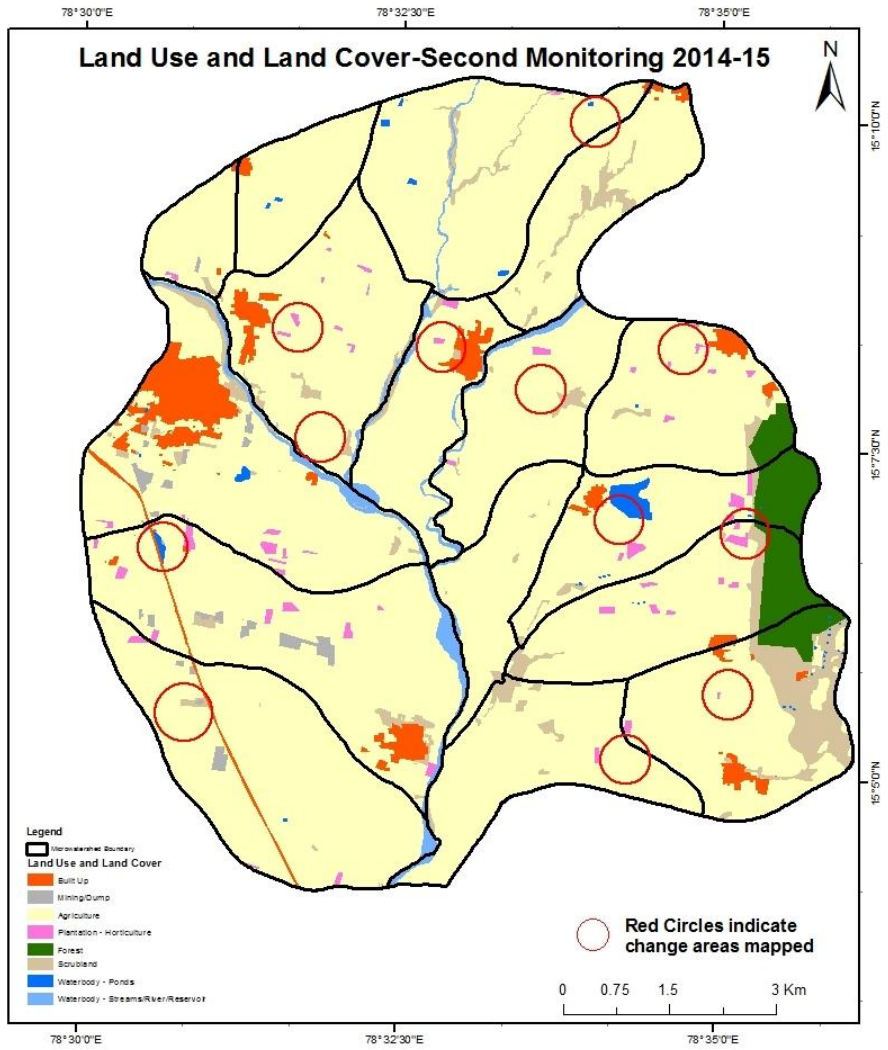


# Comparative assessment of Land Use and Land Cover for Pre and Post IWMP implementation (2013-14 to 2014-15)

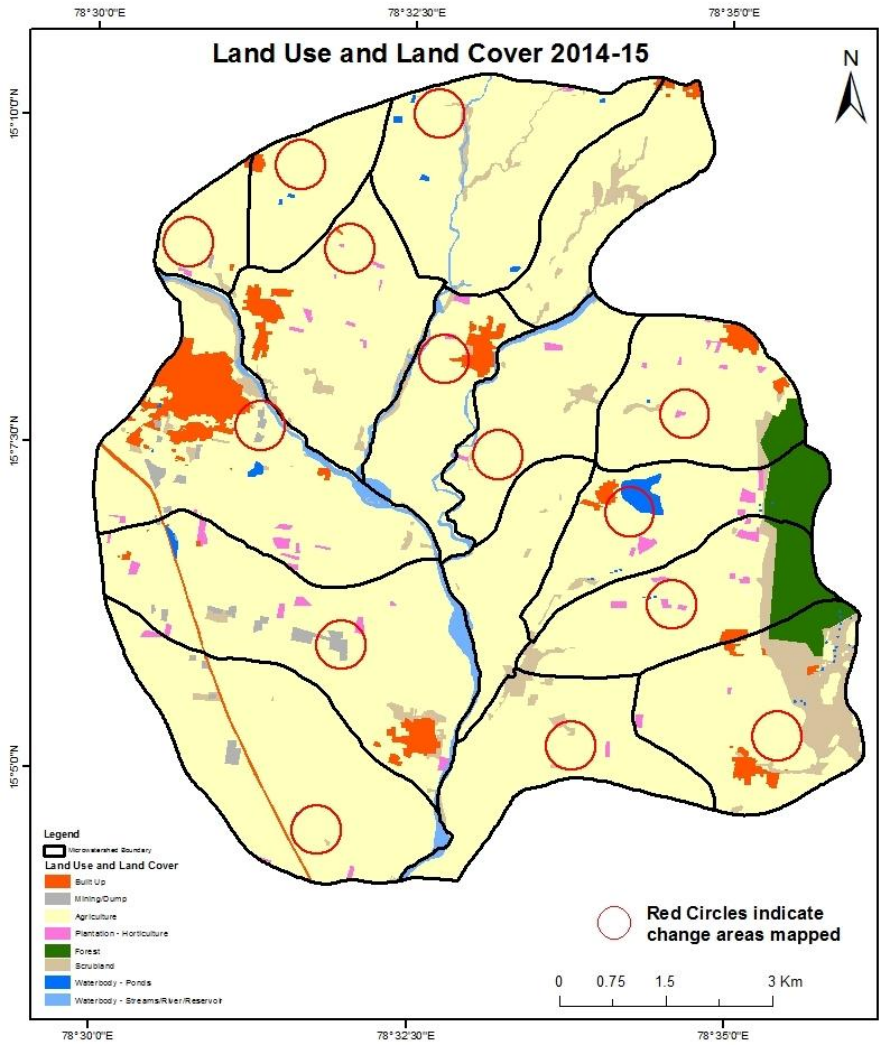
**Scale: 1:10000**

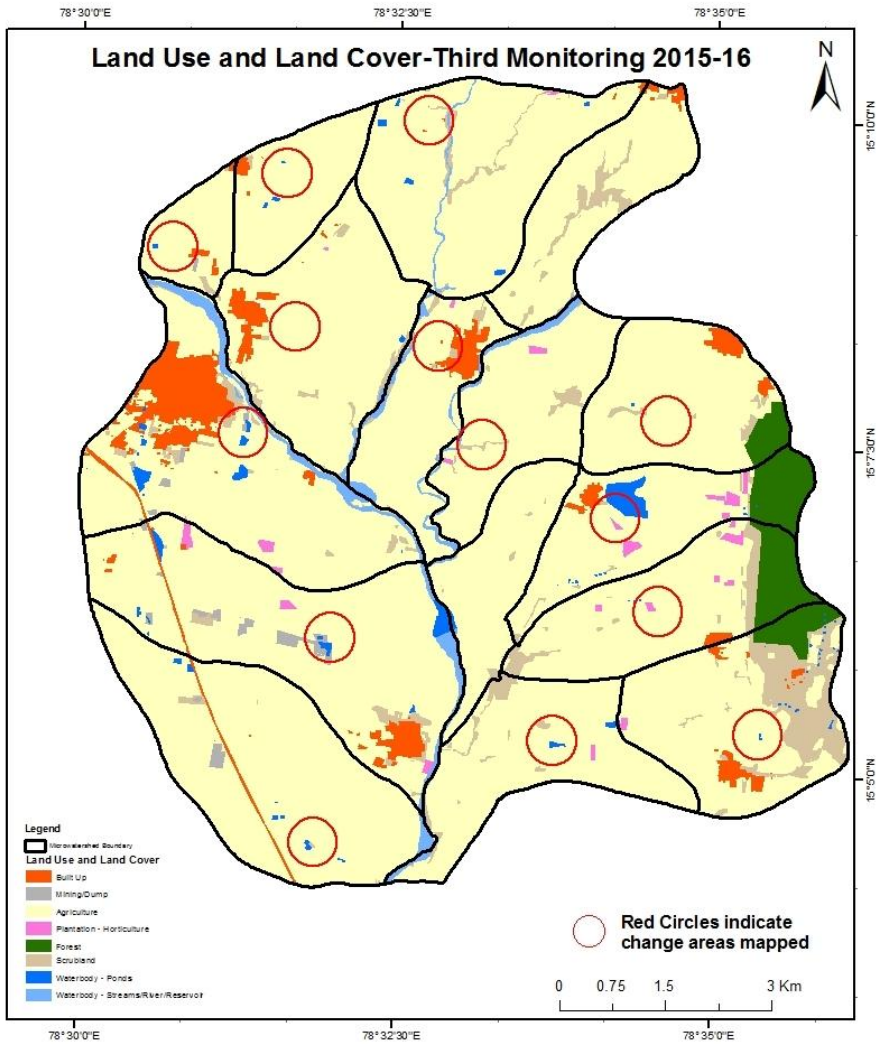


# Comparative assessment of Land Use and Land Cover for Pre and Post IWMP implementation (2014-15 to 2015-16)

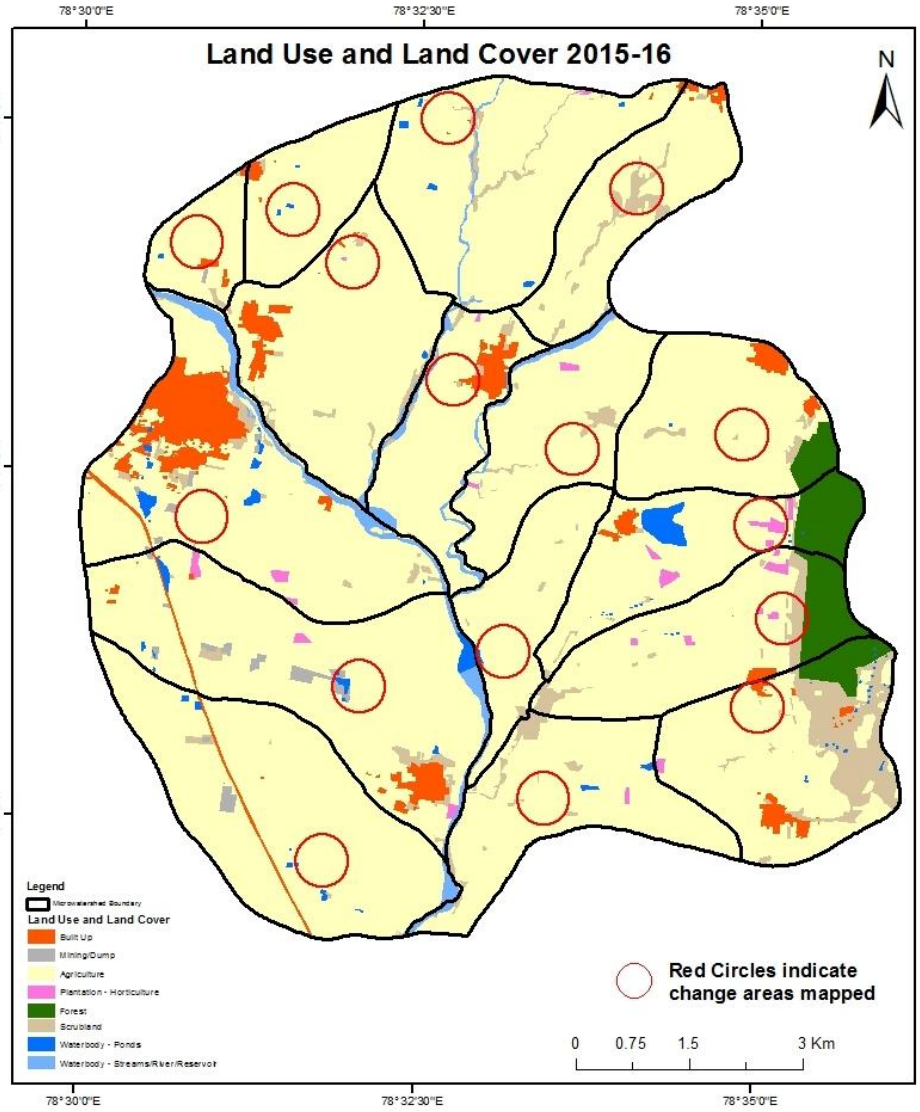
**Scale: 1:10000**

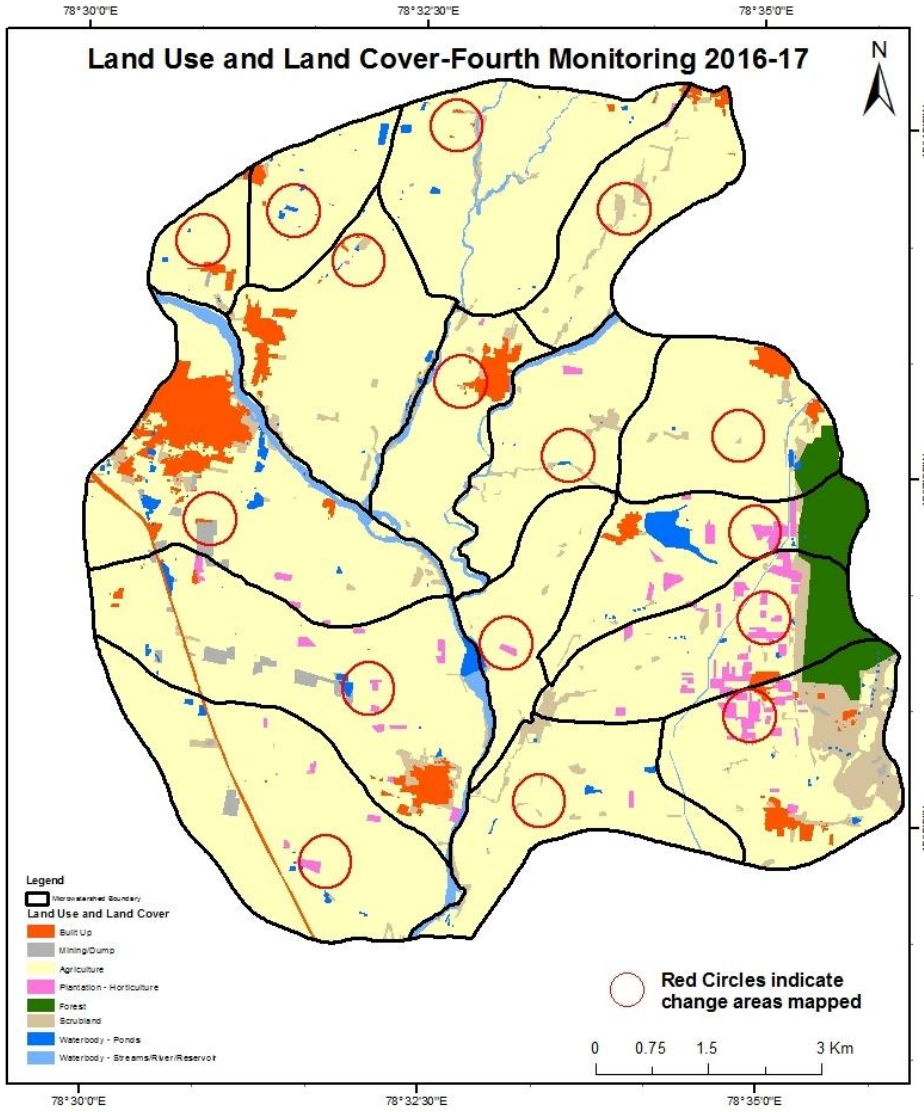


## Comparative assessment of Land Use and Land Cover for Pre and Post IWMP implementation (2015-16 to 2016-17)

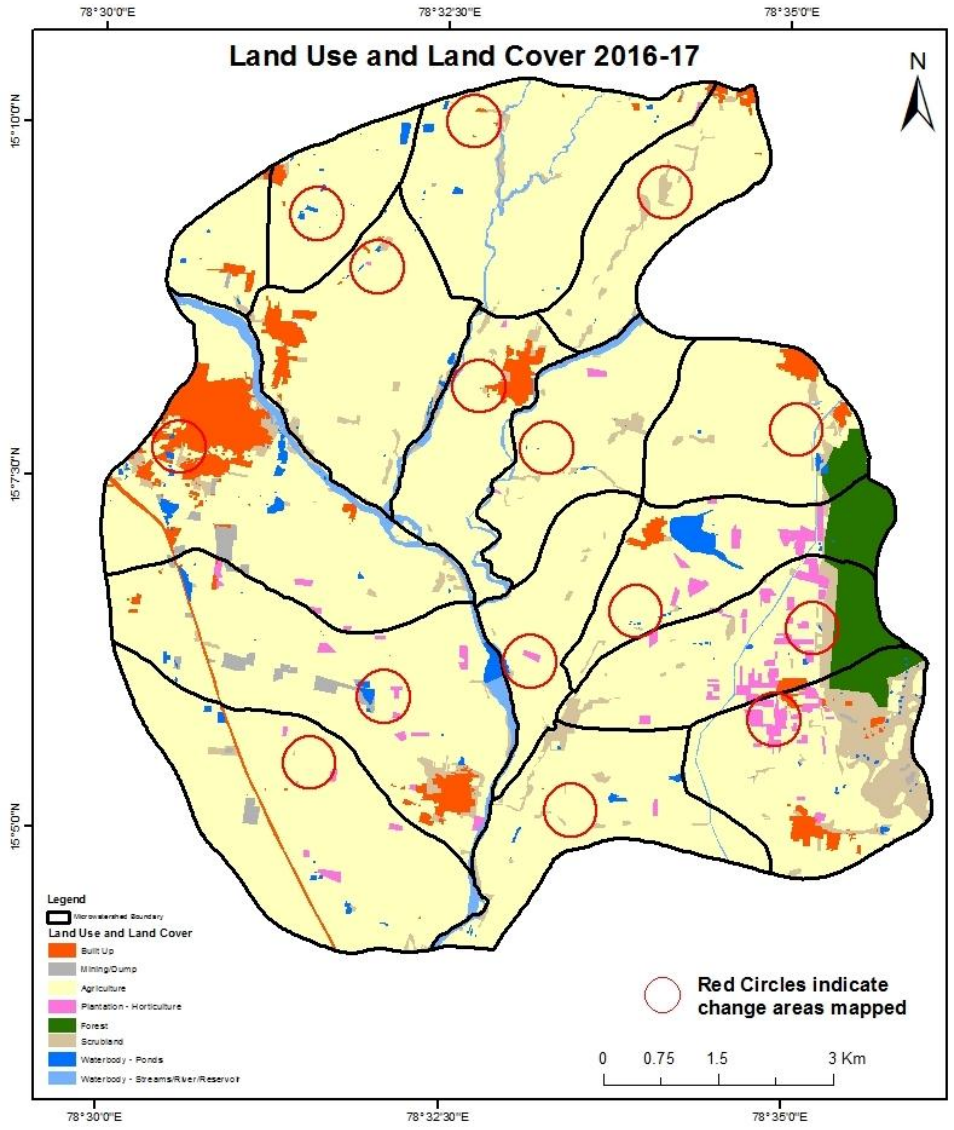
**Scale: 1:10000**

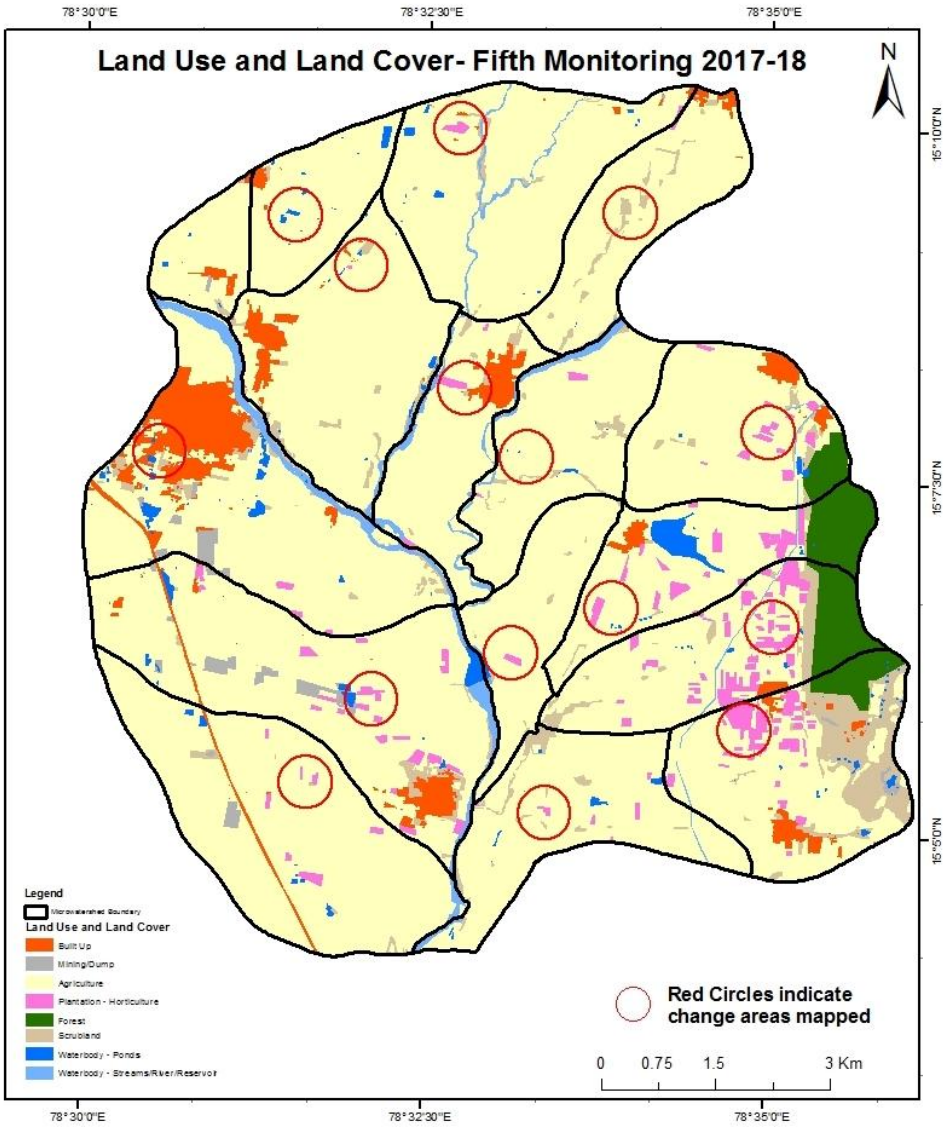


**Comparative assessment of Land Use and Land Cover for Pre and Post IWMP implementation (2016-17 to 2017-18)**

**Scale: 1:10000**

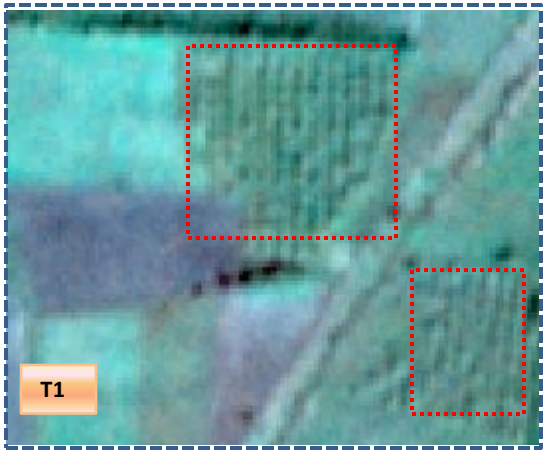


**Land Use and Land Cover changes for Pre and Post treatment dates**

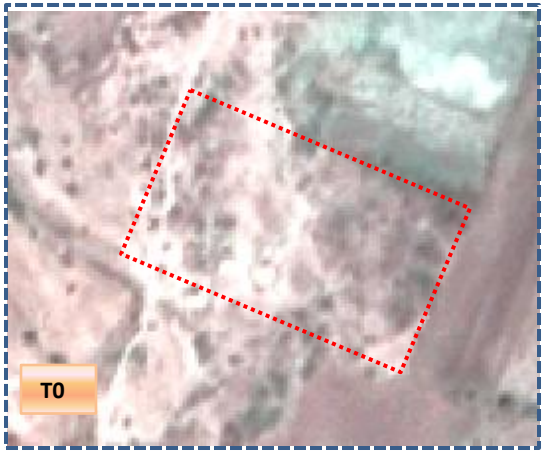
Agriculture to Plantation


T0: 2009-10

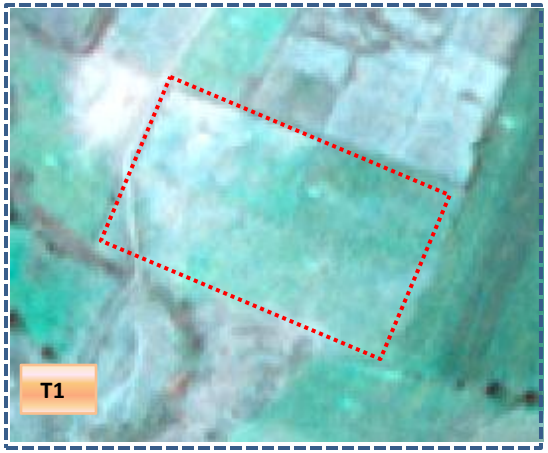



T1: 22 February 2014

Scrub to Agriculture




T0: 2009-10

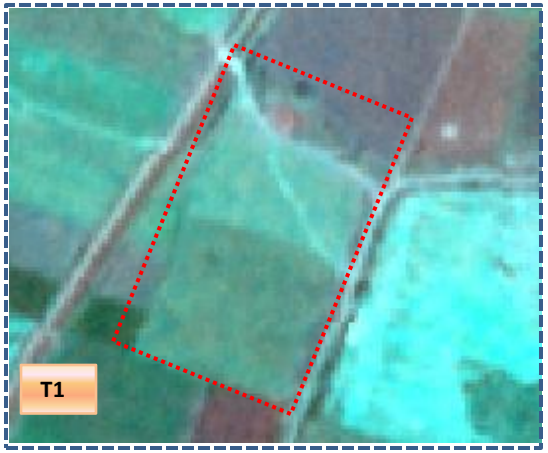



T1: 22 February 2014

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

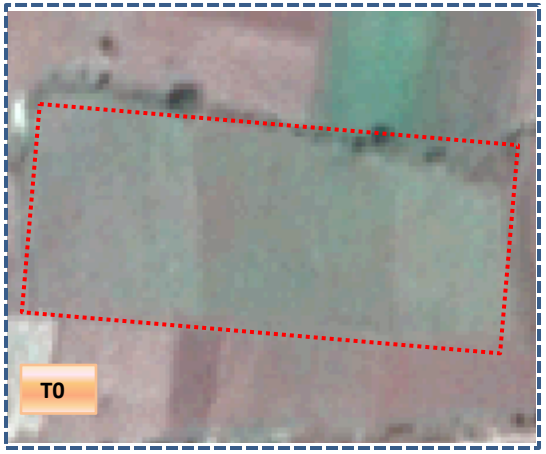
Scrub to Agriculture


T0: 2009-10

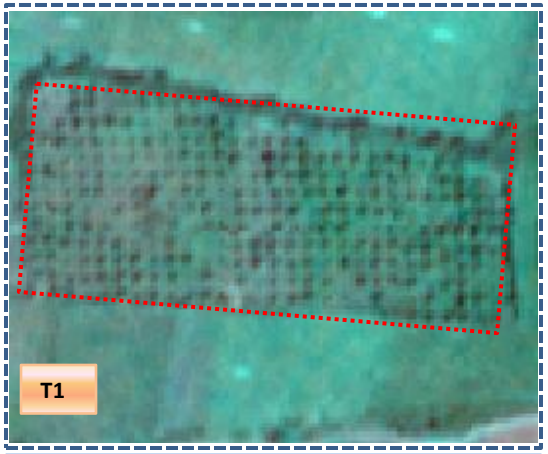



T1: 22 February 2014

Agriculture to Plantation




T0: 2009-10




T1: 22 February 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 | 315.87 | | | | | | | | | | 315.87 |
| Mining/dump | | 49.19 | | | | | | | | | 49.19 |
| Agriculture | 0.54 | 3.06 | 7285.88 | 1.66 | | | | | | 4.11 | 7295.26 |
| Plantation Horticulture | | | 10.81 | 133.73 | | | | | | | 144.55 |
| Forest | | | | | 247.86 | | | | | | 247.86 |
| Forest Plantation | | | | | | | | | | | |
| Barren Rocky | | | | | | | | | | | |
| Scrub | | | 210.11 | 2.20 | | | | 515.73 | | 0.13 | 728.16 |
| Waterbody-Streams/River | | | 4.58 | | | | | | 165.81 | | 170.39 |
| Waterbody – Ponds | | | | | | | | | | 28.25 | 28.25 |
| **Grand Total** | **316.41** | **52.25** | **7511.38** | **137.60** | **247.86** | | | **515.73** | **165.81** | **32.49** | **8979.53** |

•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 9.38 ha of the agriculture area has decreased and it is converted into built up, mining/dump, plantation and water body in T1.

• In T1 225.50 ha of the agriculture area has increased from plantation, 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-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 | 316.41 | | | | | | | | | | 316.41 |
| Mining/dump | | 48.90 | | | | | | | | 3.36 | 52.25 |
| Agriculture | 5.03 | | 7496.60 | | | | | 9.03 | | 0.72 | 7511.38 |
| Plantation Horticulture | | | 57.18 | 80.42 | | | | | | | 137.60 |
| Forest | | | 4.19 | | 243.33 | | | | | 0.34 | 247.86 |
| Forest Plantation | | | | | | | | | | | |
| Barren Rocky | | | | | | | | | | | |
| Scrub | | | 140.27 | | | | | 373.92 | | 1.53 | 515.73 |
| Waterbody-Streams/River | | | | | | | | | 165.81 | | 165.81 |
| Waterbody – Ponds | | | | | | | | | | 32.49 | 32.49 |
| **Grand Total** | **321.44** | **48.90** | **7698.25** | **80.42** | **243.33** | | | **382.95** | **165.81** | **38.44** | **8979.53** |

•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 14.78 ha of the agriculture area has been decreased and it is converted into built up, scrubland and water body in T2.

• In T2 201.64 ha of the agriculture area has increased from plantation, forest and scrubland 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-2014-15 to 2015-16**

| Land cover | Monitoring period (T3) | | | | | | | | | | Units in Hectare |
|---|---|---|---|---|---|---|---|---|---|---|---|
| T2 | Built up | Mining/ dump | Agriculture | Plantation Horticulture | Forest | Forest Plantation | Barren Rocky | Scrub | Waterbody-Streams/River | Water body Ponds | Grand Total |
| Built up | 321.44 | | | | | | | | | | 321.44 |
| Mining/dump | | 34.09 | | | | | | | | 14.81 | 48.90 |
| Agriculture | 17.91 | 1.57 | 7606.01 | 3.20 | | | | 61.44 | | 8.12 | 7698.25 |
| Plantation Horticulture | | | 38.60 | 41.82 | | | | | | | 80.42 |
| Forest | | | | | 243.33 | | | | | | 243.33 |
| Forest Plantation | | | | | | | | | | | |
| Barren Rocky | | | | | | | | | | | |
| Scrub | 0.53 | | 29.89 | | | | | 334.52 | 17.24 | 0.77 | 382.95 |
| Waterbody-Streams/River | | | 1.40 | | | | | 1.71 | 151.80 | 10.89 | 165.81 |
| Waterbody – Ponds | | | | | | | | | | 38.44 | 38.44 |
| **Grand Total** | **339.88** | **35.66** | **7675.90** | **45.01** | **243.33** | | | **397.67** | **169.04** | **73.03** | **8979.53** |

•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 92.24 ha of the agriculture area has been decreased and it is converted into built up, mining/dump, plantation, scrubland and water body in T3.

• In T3 69.90 ha of the agriculture area has increased from plantation, 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-2015-16 to 2016-17**

| 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 | 339.88 | | | | | | | | | | 339.88 |
| Mining/dump | | 32.56 | | | | | | | | 3.10 | 35.66 |
| Agriculture | 20.37 | 16.83 | 7453.87 | 99.00 | | | | 51.77 | 15.83 | 18.24 | 7675.90 |
| Plantation Horticulture | 0.65 | | 7.25 | 37.11 | | | | | | | 45.01 |
| Forest | | | 0.47 | | 242.06 | | | | | 0.80 | 243.33 |
| Forest Plantation | | | | | | | | | | | |
| Barren Rocky | | | | | | | | | | | |
| Scrub | 4.28 | 7.50 | 24.79 | | | | | 347.45 | 8.97 | 4.69 | 397.67 |
| Waterbody-Streams/River | | | 10.06 | | | | | | 158.98 | | 169.04 |
| Waterbody – Ponds | | 0.40 | 3.31 | | | | | | | 69.32 | 73.03 |
| **Grand Total** | **365.18** | **57.30** | **7499.75** | **136.11** | **242.06** | | | **399.22** | **183.78** | **96.15** | **8979.53** |

•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 222.03 ha of the agriculture area has been decreased and it is converted into built up, mining/dump, plantation, scrubland and water body in T4.

• In T4 45.88 ha of the agriculture area has increased from plantation, forest, 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-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 | 365.18 | | | | | | | | | | 365.18 |
| Mining/dump | | 55.90 | | | | | | | | 1.39 | 57.30 |
| Agriculture | 2.87 | | 7411.74 | 82.73 | | | | 1.57 | 0.66 | 0.17 | 7499.75 |
| Plantation Horticulture | 0.04 | | 0.53 | 135.54 | | | | | | | 136.11 |
| Forest | | | | | 242.06 | | | | | | 242.06 |
| Forest Plantation | | | | | | | | | | | |
| Barren Rocky | | | | | | | | | | | |
| Scrub | 1.99 | 2.87 | 22.39 | | | | | 371.14 | | 0.83 | 399.22 |
| Waterbody-Streams/River | | | 3.07 | | | | | | 180.71 | | 183.78 |
| Waterbody – Ponds | | | 1.19 | | | | | | | 94.95 | 96.15 |
| **Grand Total** | **370.08** | **58.77** | **7438.92** | **218.27** | **242.06** | | | **372.71** | **181.37** | **97.35** | **8979.53** |

•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 88.01 ha of the agriculture area has been decreased and it is converted into built up, plantation, scrubland and water body in T5.

• In T5 27.18 ha of the agriculture area has increased from plantation, 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 increase of 80.08 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 216.12 & 186.87 Hectares From T0-T1 & T1-T2 respectively and overall increase of 382.23 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 73 Hectares in Plantation/Horticulture area as compared between 2009-10 (T0) & 2017-18 (T5) years.
6. There is a decrease of 355.45 Hectares in Scrubland area as compared between 2009-10 (T0) & 2017-18 (T5) years.
7. Farm ponds (47) is visible on IWMP Bhuvan Srishti portal out of Bhuvan Drishti photo of Farm ponds (47) verified from the portal.