# MONITORING OF IWMP WATERSHED PROJECTS USING GEO-INFORMATION

## SUMMARY REPORT

IWMP-Batch-IV

Chittoor -49/2012-13
Andhra Pradesh

Submitted to NRSC, Balanagar, Hyderabad
December-2022

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


AGRICULTURE & SOIL DIVISION
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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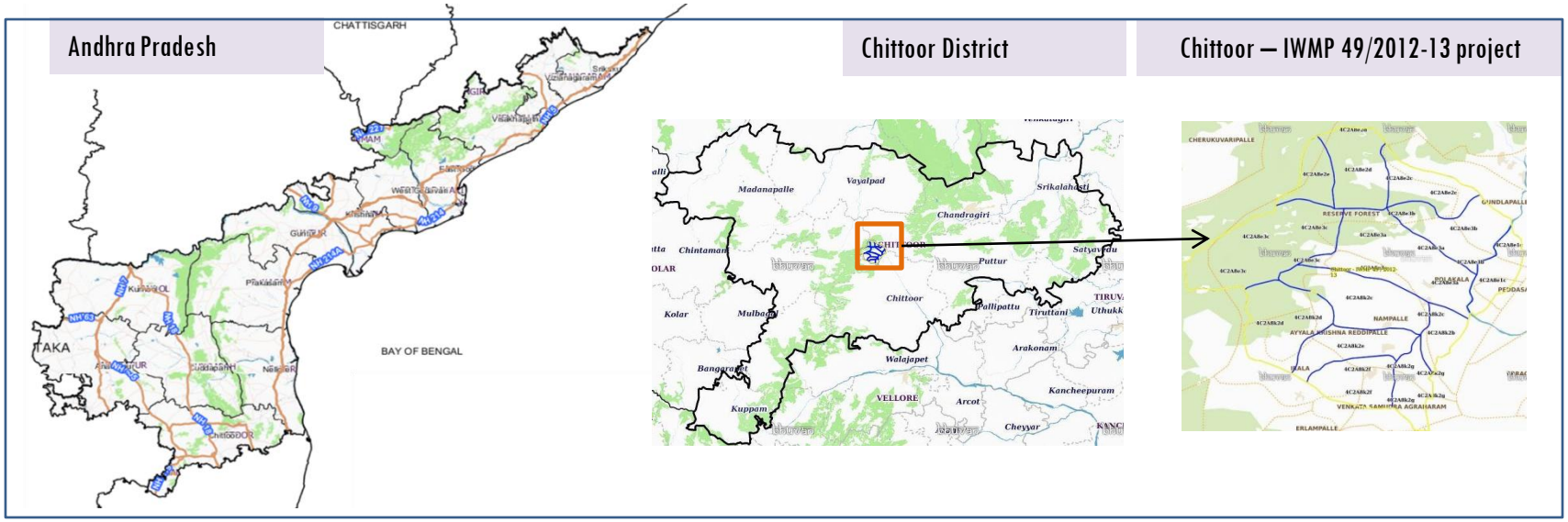
# EXECUTIVE SUMMARY

- 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-49/2012-13, Chittoor District of Andhra Pradesh. The total geographical area of the project is **8,569** ha. It comprises of 13 micro watersheds.
- In the project area 364 Drishti photos were uploaded showing all water harvesting structures of check dams/Rock fill dam, recharge pits etc,.
- Project area as per image analysis has witnessed distinguishable increase in farm ponds, showing new farm ponds or dug out pits and check dams and drainage treatments .
- Water bodies have shown an increase by 88 ha , which correspond to the various water bodies that have been converted into other land use classes in this period.
- Major percentage i.e. 34.7 % is covered by the agriculture, 37.7 % is covered by forest and 5.3 % is covered by scrubland and remaining by other land use classes.

# PROJECT : CHITTOOR – IWMP-49/2012-13
# DISTRICT : CHITTOOR , STATE : ANDHRA PRADESH

- The study area falls in Irala Mandal of Chittoor district of Andhra Pradesh state. The total geographical area of the project is **8,569** ha. It comprises of 13 micro watersheds. Location Map of the study area is shown in Figure below. Analysis is done for 2012-13 (T0) period (***Batch -1***) projects taking 2020-21 (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.

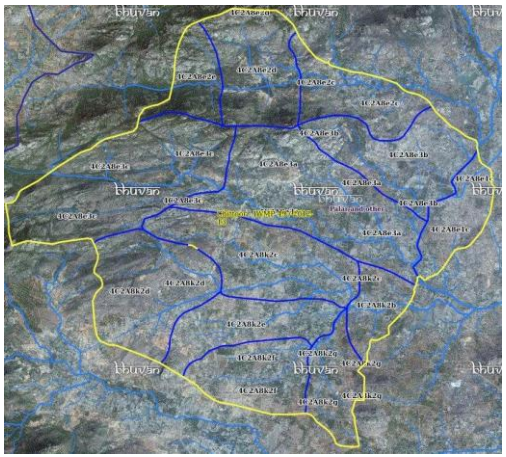
# Satellite Data and Ancillary Data

| Satellite data* | T0-A** | T0-B** | T5 |
|---|---|---|---|
| | 2012-13 | 2011-12 | 2020-21 |
| LISS IV | 2012-13 | | |
| SCENE 1 | | | 5-Oct-20 |
| SCENE2 | | | |
| SCENE 3 | | | |
| SCENE 4 | | | |
| | | | |
| CARTO | 2012-13 | | |
| SCENE 1 | | | 5-Oct-20 |
| 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 | 364 |
| 4 | Detailed Project Report | | |
| | | | |

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



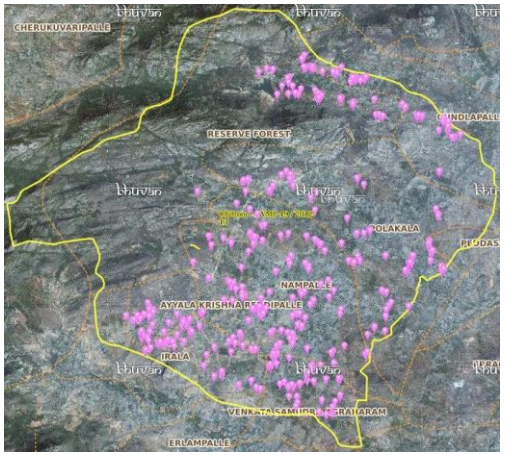
Legend

Drainage (1:10000 Scale)

MWS Boundary

Project Boundary

# Natural Color Composite overlaid with Drishti Points




Drishti Upload Status

# Classification of the Activities

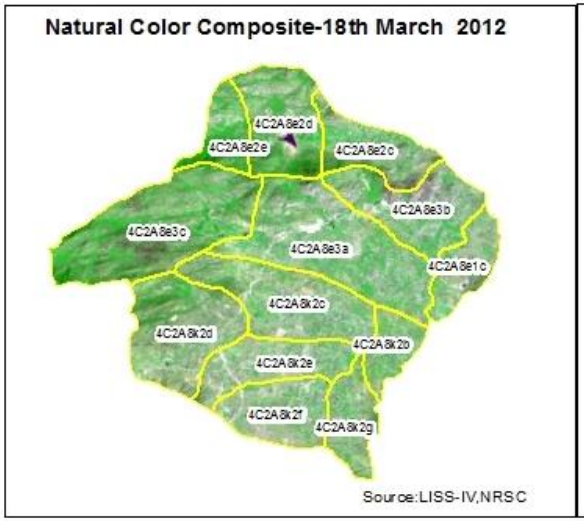
| Sr. No | Activity | Drishti Photo | Visible on satellite |
|---|---|---|---|
| 1 | Agriculture | 84 | 60 |
| 2 | Bunding | 0 | 0 |
| 3 | Black planting | 0 | 0 |
| 4 | Bund Planting/Horticulture | 0 | 0 |
| 5 | Trench | 0 | 0 |
| 6 | Field Bunds | 0 | 0 |
| 7 | Existing activity | 0 | 0 |
| 8 | Checks & Plugs | 13 | 13 |
| 9 | Entry point Activity | 51 | 51 |
| 10 | Farm ponds/Dug out pit | 0 | 0 |
| 11 | Civil work-Check dams /Rock fill dam | 163 | 160 |
| 12 | Drainage treatment /Nala Revetment, loose boulder structure, gully check | 0 | 0 |
| 13 | Land Developments (afforestation, horticulture and bund plantation of teak) | 0 | 0 |
| 14 | Lm (fodder development, varmi compost) | 0 | 0 |
| 15 | Livelihood Activities (Horticulture) | 25 | 20 |
| 16 | Water harvesting structures (recharge pits and check dams) | 0 | 0 |
| 17 | Entry Point Activity (Cattle thought) | 0 | 0 |
| 18 | Others | 91 | 60 |
| | **TOTAL** | **427** | **364** |

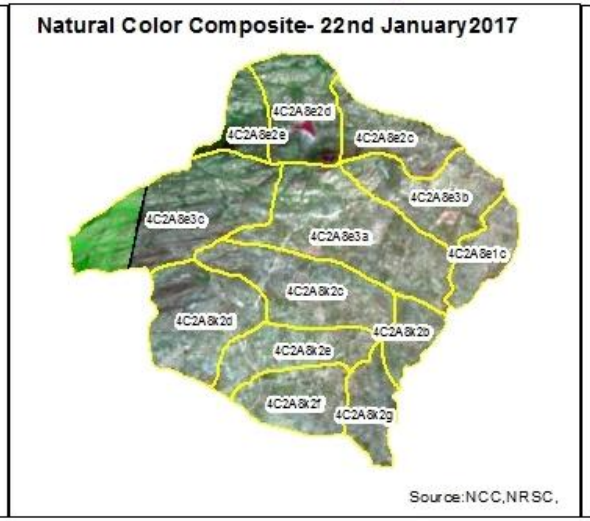
# MONITORING IN THE PROJECT AREA

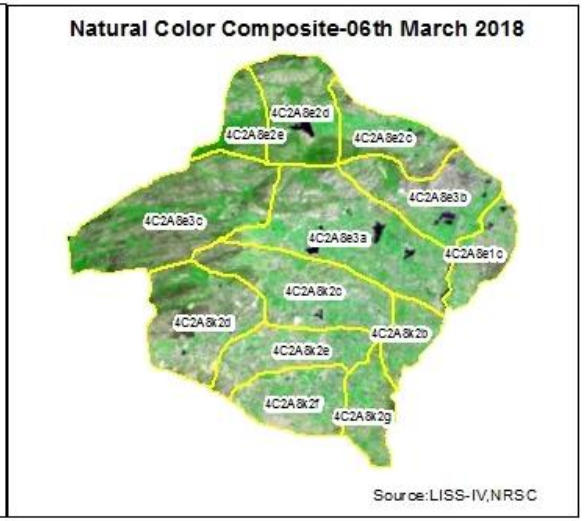
## Site Wise Changes in the Project

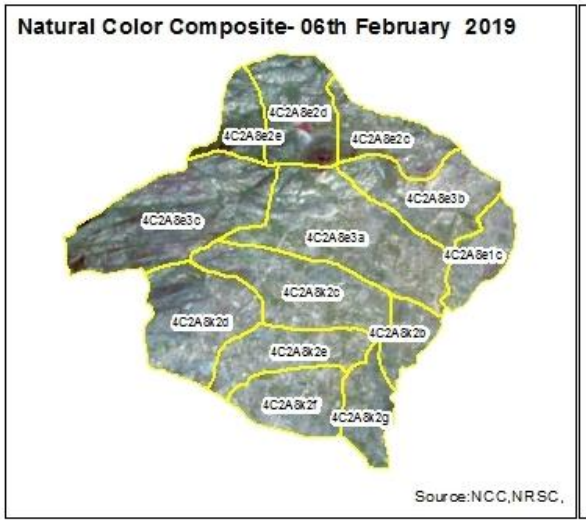
- Impacts of the activities carried out are presented through combination of Drishti and Srishti captures.
- T0 is the baseline period before implementation (2012-13) and T5 is 2020-21 period for monitoring.
- Captures are also provided wherever changes are observed in satellite images, that may match expected activity related impact, even though they don't have Drishti report yet.

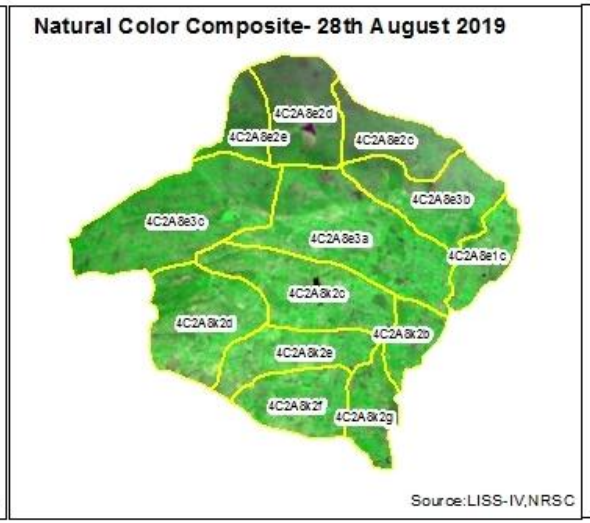
# Natural Colour Composite (NCC)

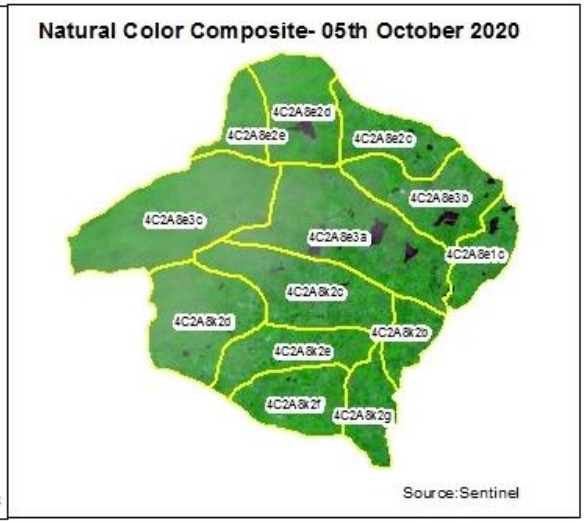


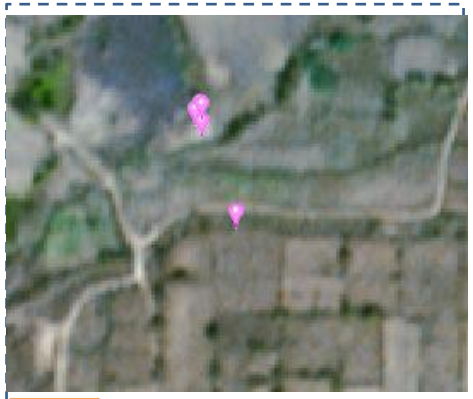



# Monitoring of activities in Chittoor District Andhra Pradesh. IWMP-49/2012-13

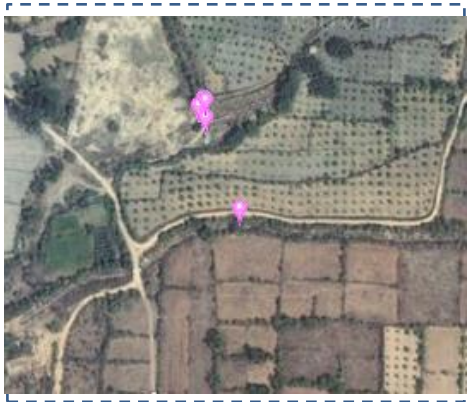
T0 Satellite data 2010

T1 Satellite data 2014



T2 Satellite data 2017

T3 Satellite data 2018



T4 Satellite data 2019

T5 Satellite data 2020

Drishti Id. 818421

**Check Dam**

# Monitoring of activities in Chittoor Dt Andhra Pradesh. IWMP-49/2012-13


T0:2012-13


T1: 22 January 2017

Drishti Sl no. 859153 MWS : 4C2A8k2c

**Farm pond**


T0:2012-13

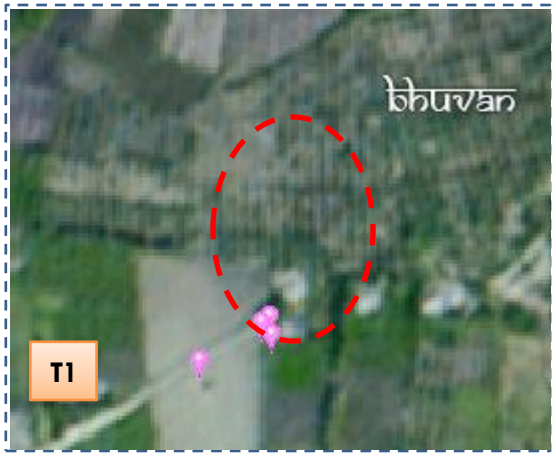

T1: 22 January 2017

Drishti Sl no. 1646207 MWS : 4C2A8k2c

**Farm pond**

## Monitoring of activities in Chittoor Dt Andhra Pradesh. IWMP-49/2010-11


T0: 2012-13




T1: 22 January 2017

Drishti Sl no. 627721 MWS : 4C2A8k2c

**Horticulture**


T0: 2012-13


T1: 22 January 2017

Drishti Sl no. 829019 MWS :4C2A8e3c

**Check dam**

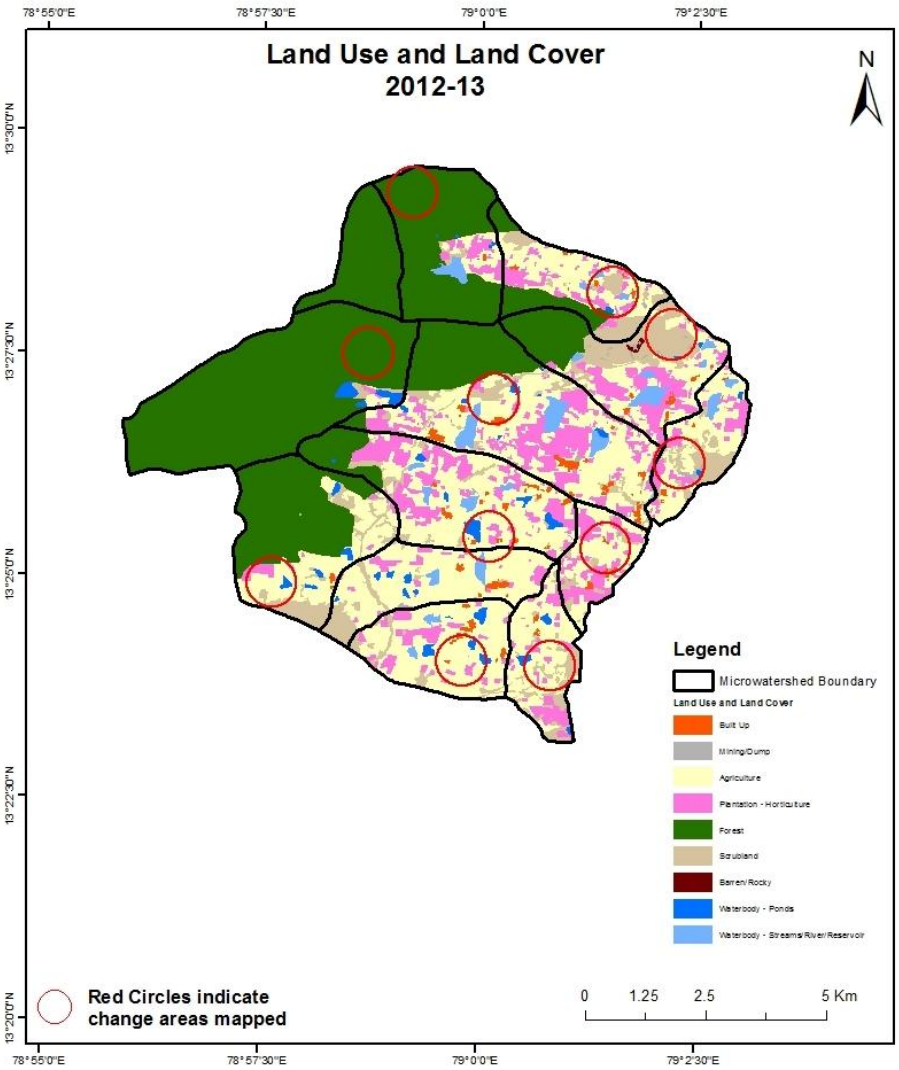
# MONITORING IN THE PROJECT AREA

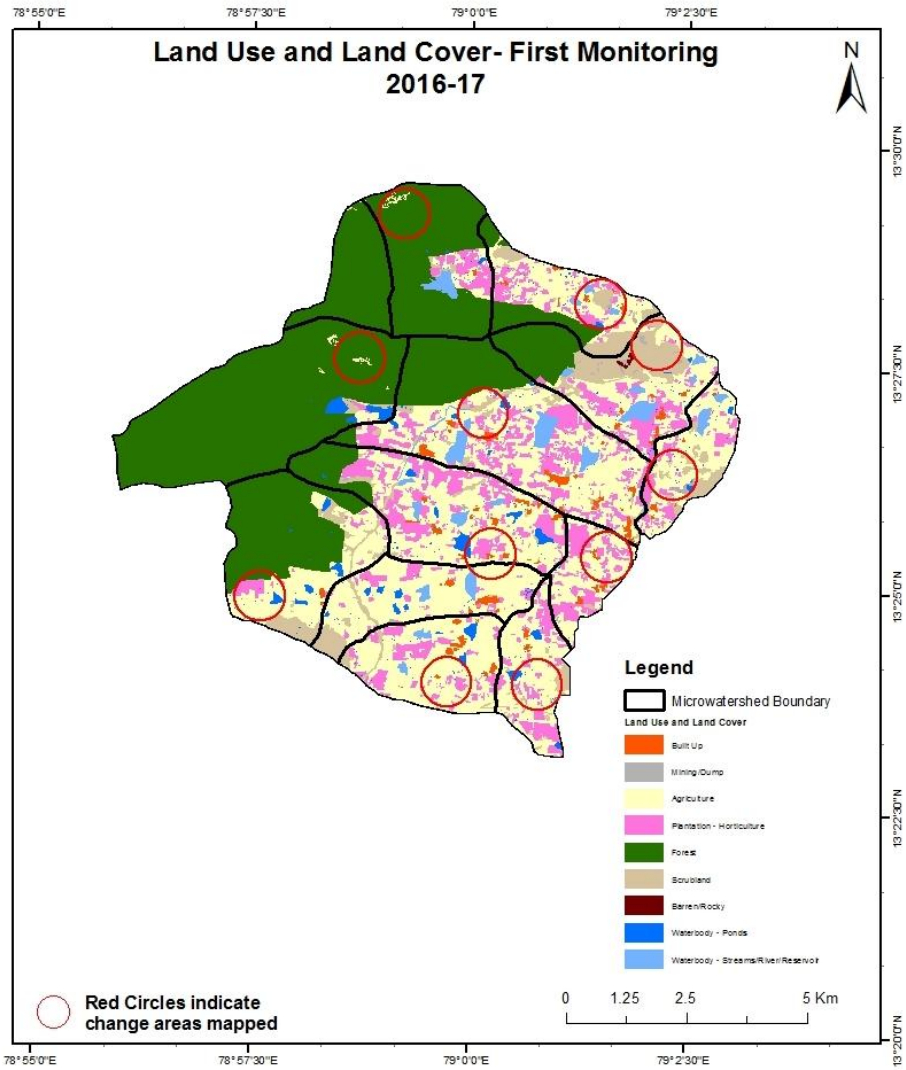
## Land use and Land cover Changes in the Project

- 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 (2012-13) and row represents the T5 (2020-21)

# Comparative assessment of Land Use and Land Cover for Pre and Post IWMP implementation (2012-13 to 2016-17)

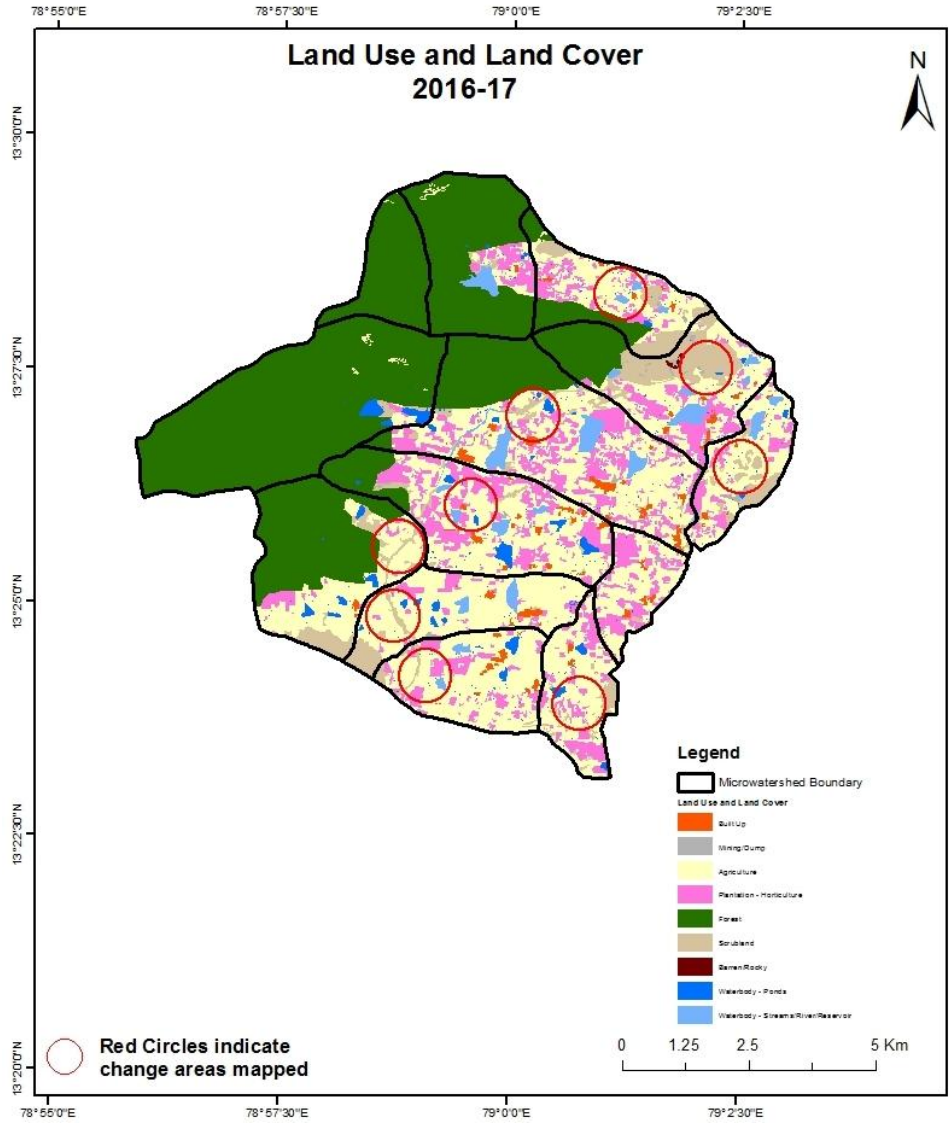
Scale: 1:10000

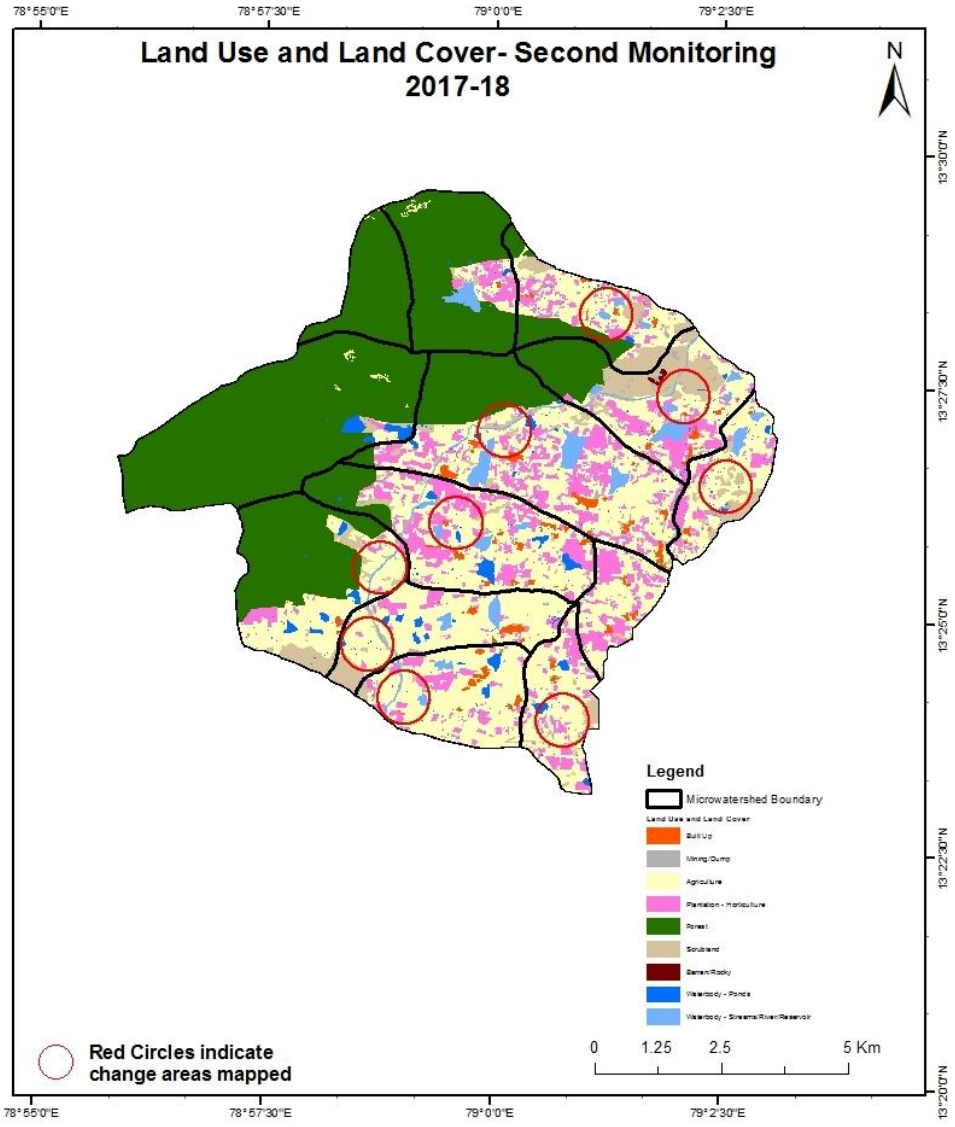


## Comparative assessment of Land Use and Land Cover for Pre and Post IWMP implementation (2016-17 to 2017-18)

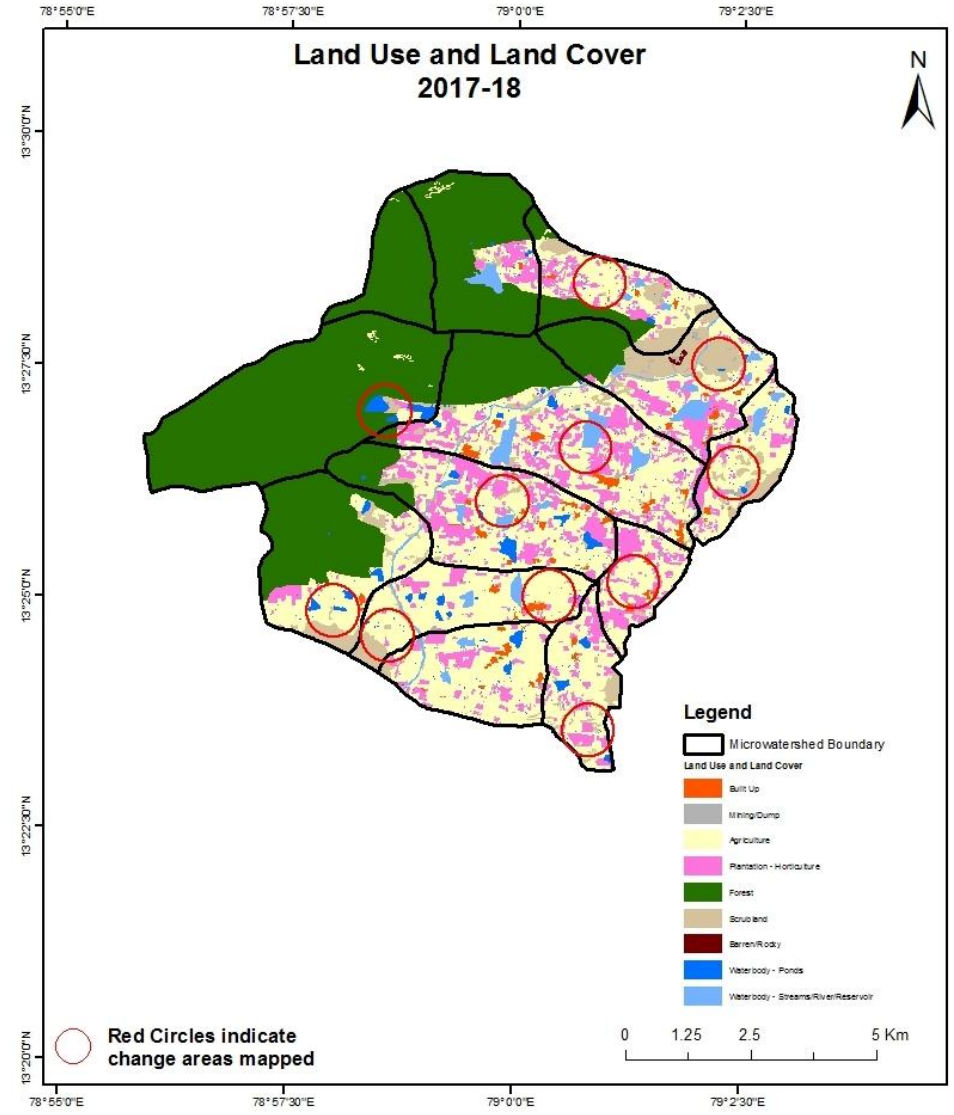
**Scale: 1:10000**

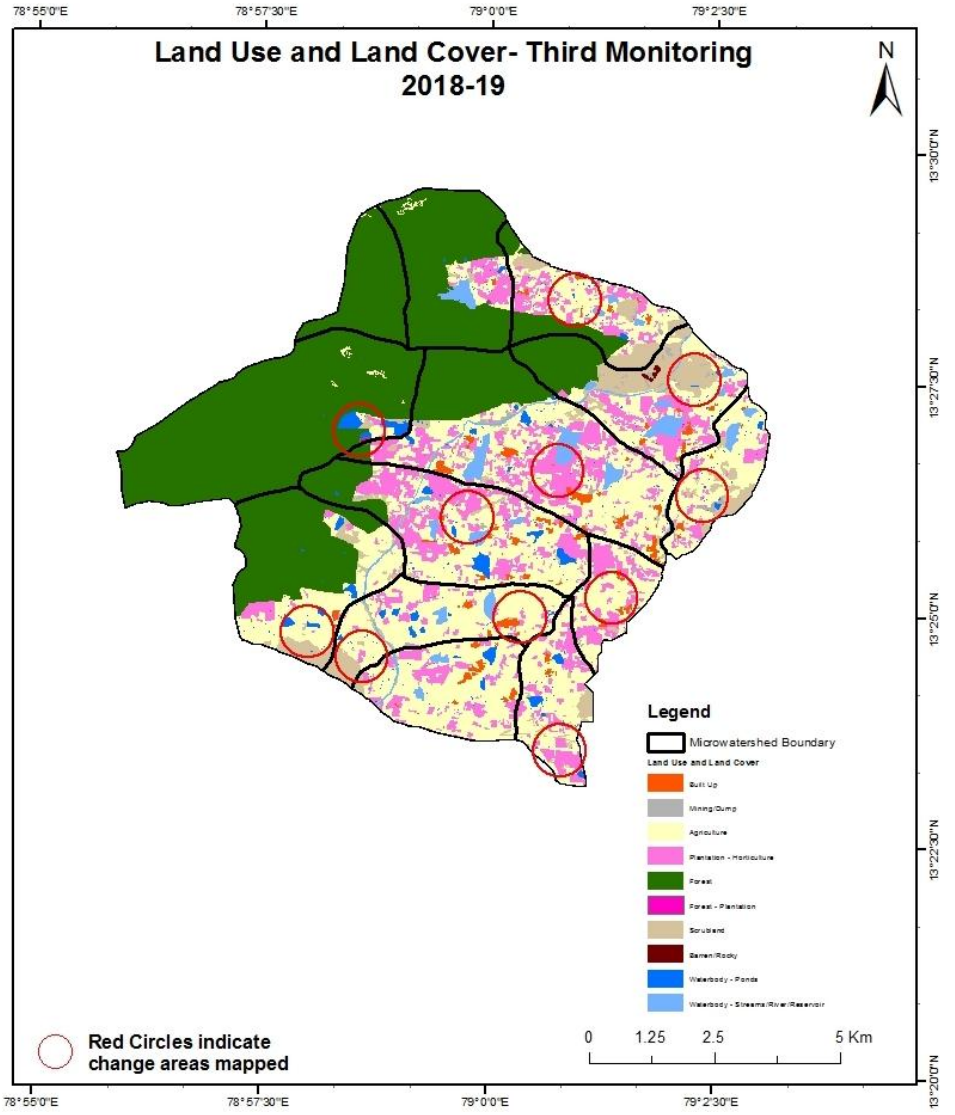


**Comparative assessment of Land Use and Land Cover for Pre and Post IWMP implementation (2017-18 to 2018-19)**

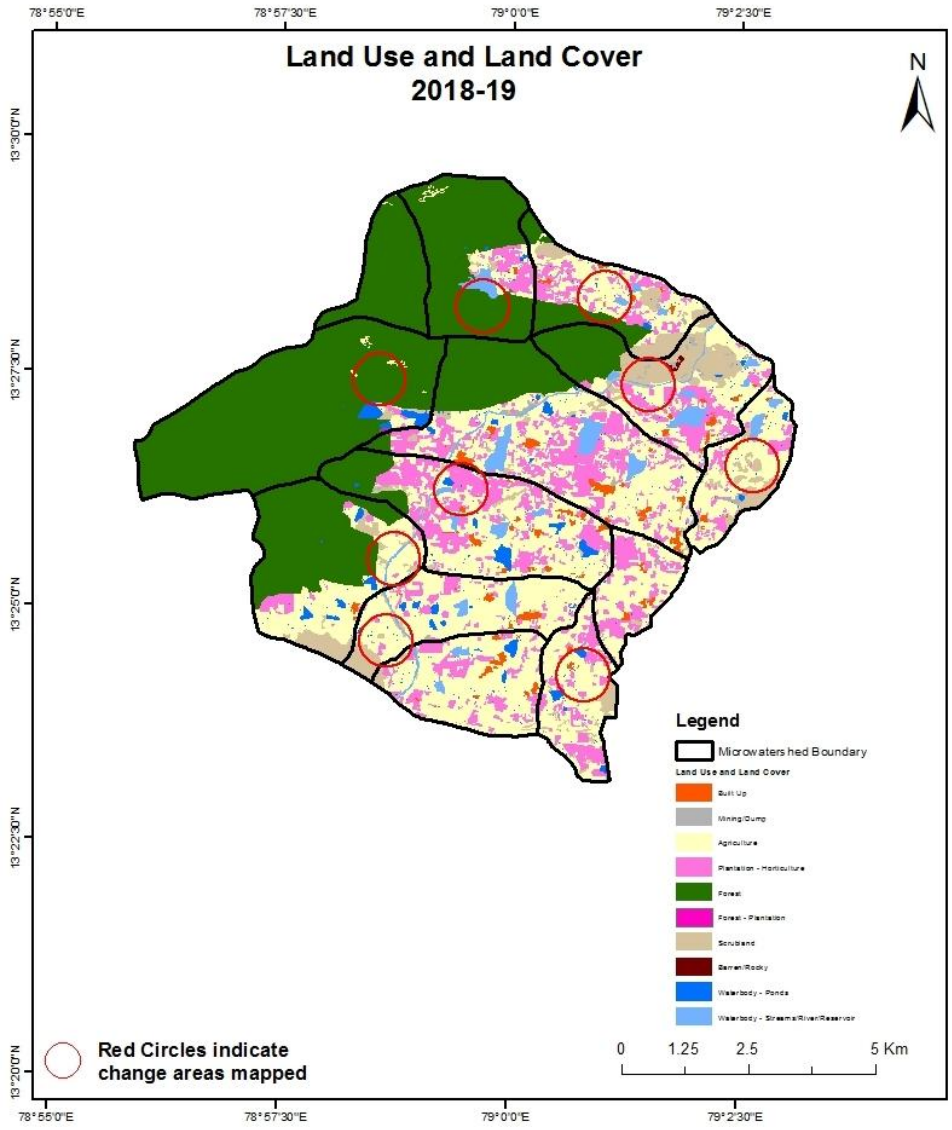
**Scale: 1:10000**

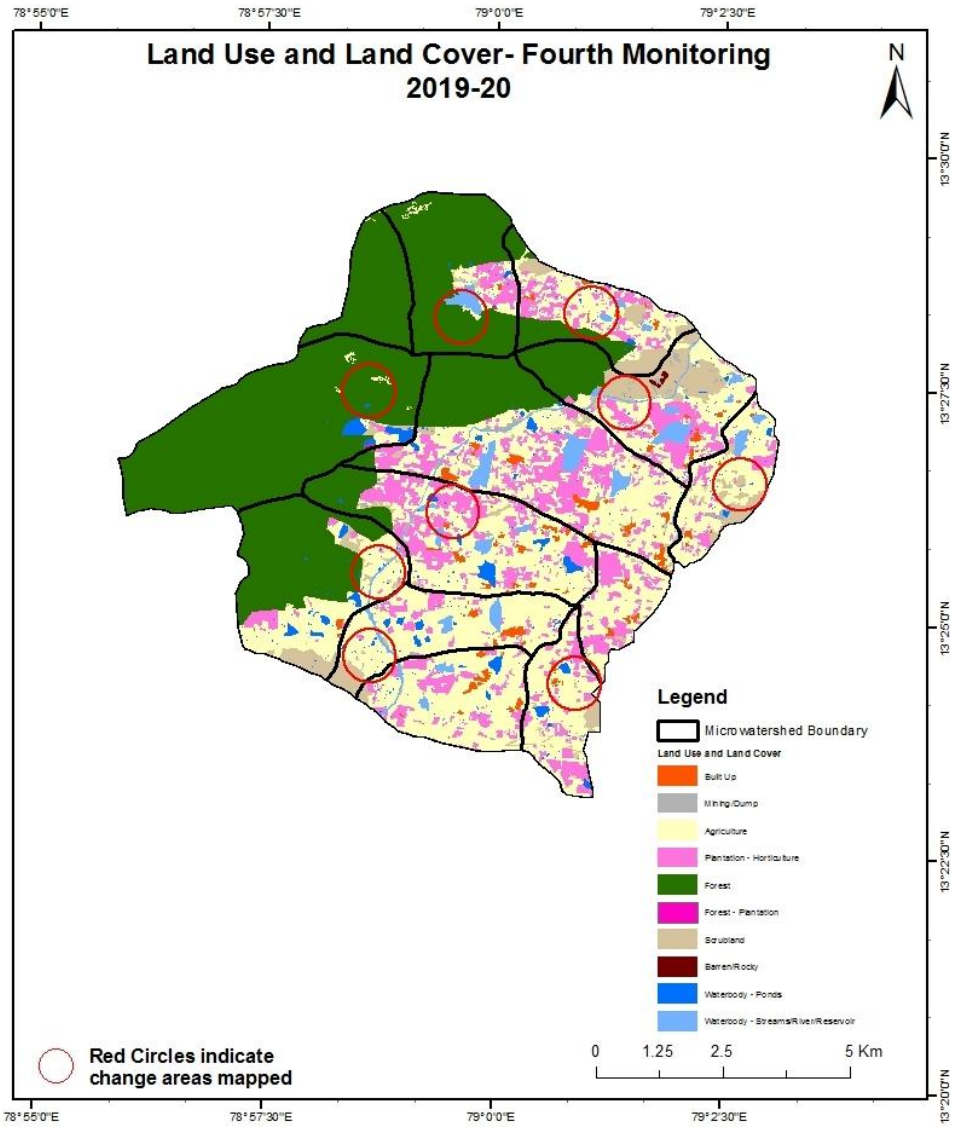


**Comparative assessment of Land Use and Land Cover for Pre and Post IWMP implementation (2018-19 to 2019-20)**

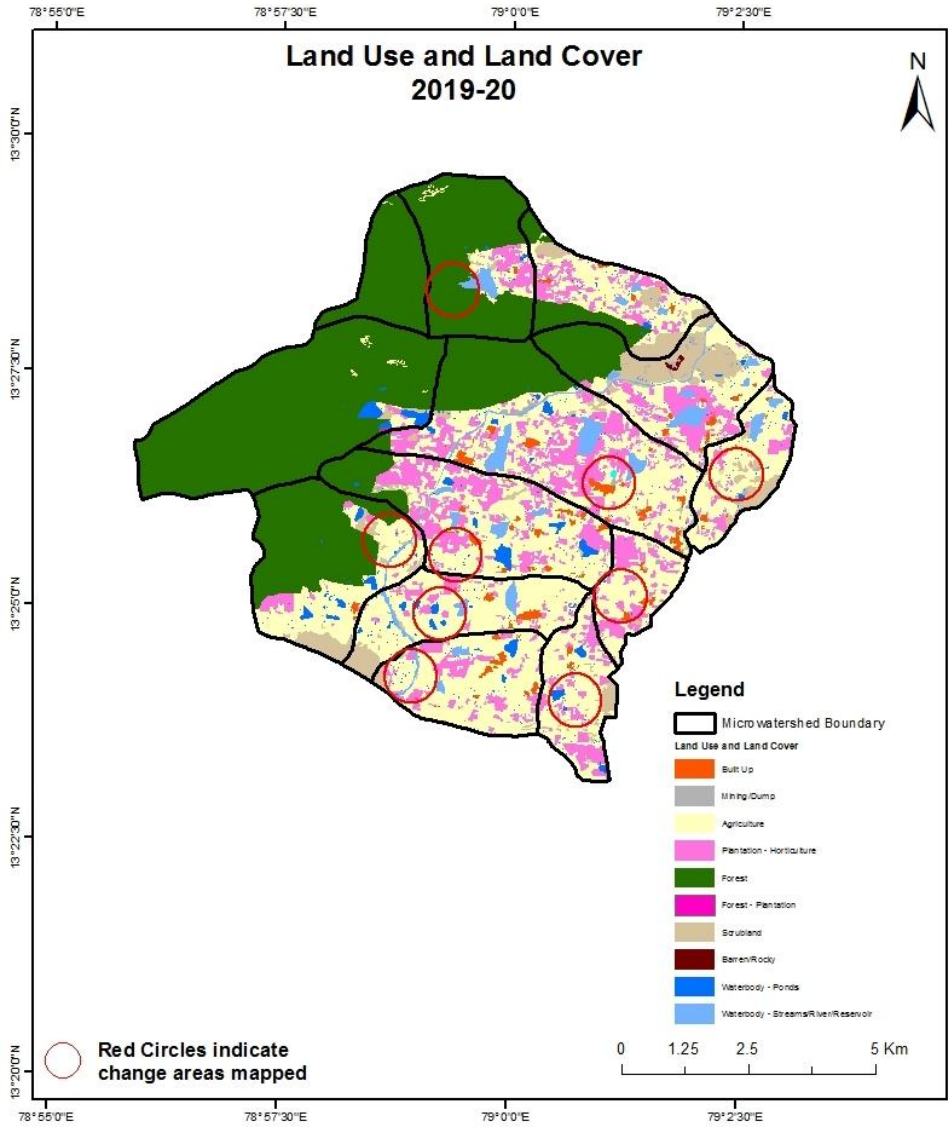
**Scale: 1:10000**

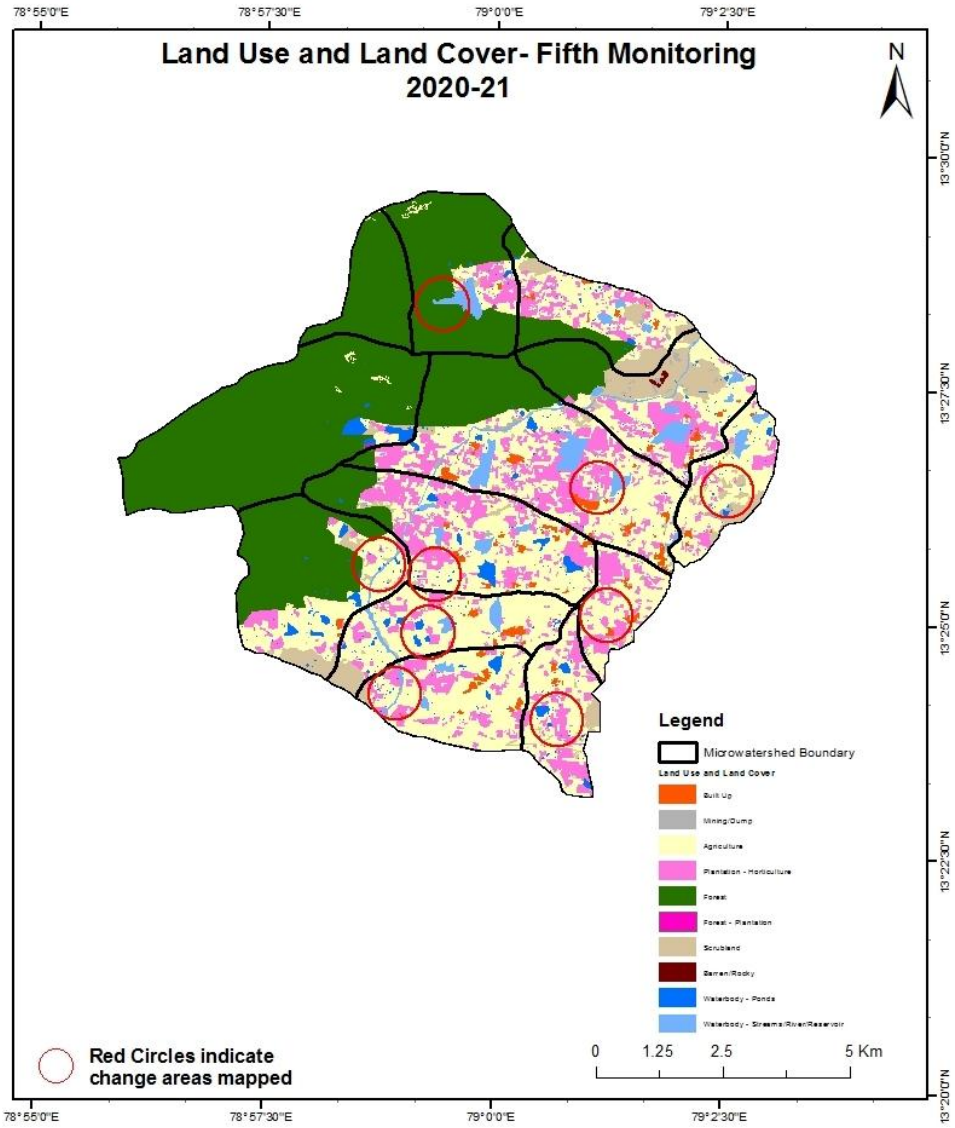


**Comparative assessment of Land Use and Land Cover for Pre and Post IWMP implementation (2019-20 to 2020-21)**

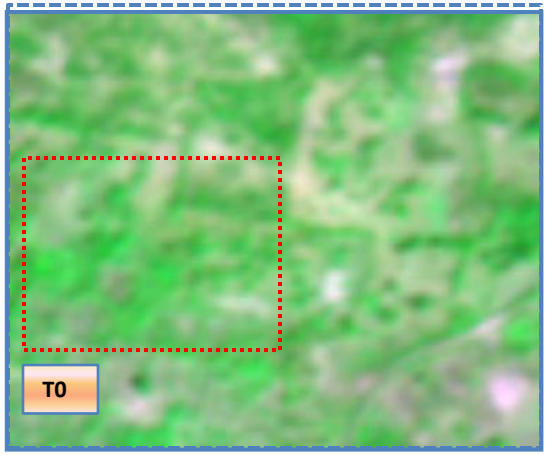
**Scale: 1:10000**



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

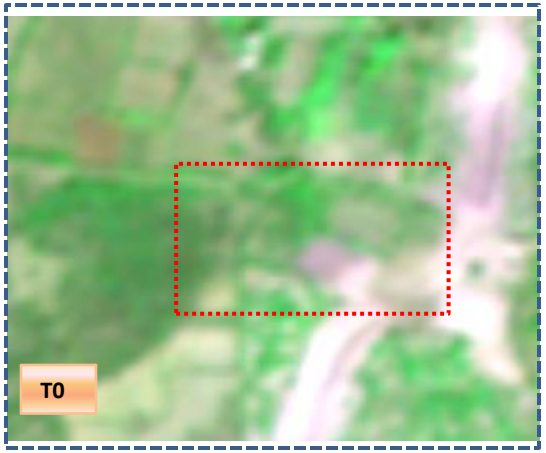
Agriculture to Plantation



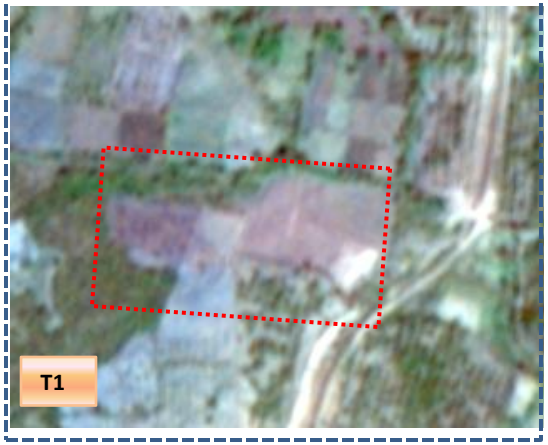

T0: 2012-13(79°0'1.656"E 13°28'48.99"N)


T1: 22 January 2017

Scrub to Agriculture



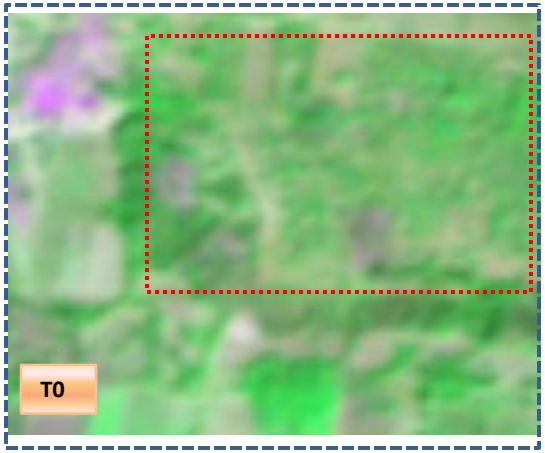

T0: 2012-13(78°59'0.329"E 13°26'6.536"N )



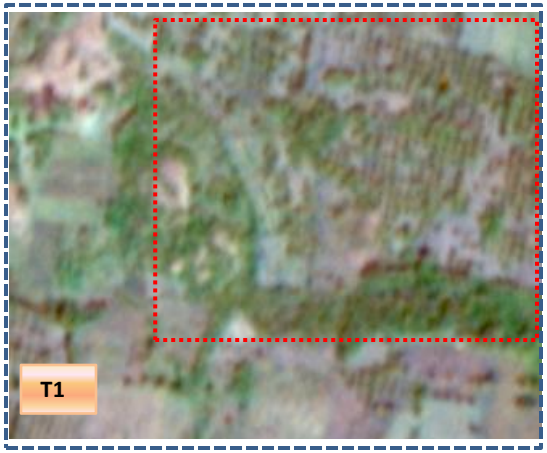

T1: 22 January 2017

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

Scrub to Plantation

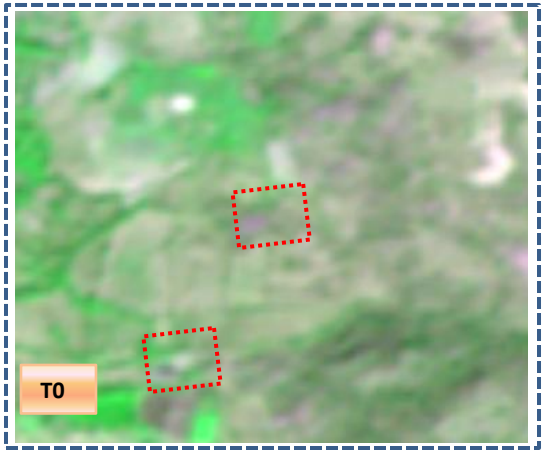



T0: 2012-13(79°1'41.138"E 13°25'27.82"N )




T1: 22 January 2017

Scrub to Water body




T0: 2012-13(79°2'25.184"E 13°26'28.842"N)


T1: 22 January 2017

**Table showing change matrix depicting Land cover transitions 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 | 108.79 | | | | | | | | | | **108.79** |
| Mining/dump | | 17.81 | 1.55 | 0.25 | | | | | | 0.34 | **19.94** |
| Agriculture | 9.07 | 0.82 | 2657.58 | 276.82 | | | | | 5.72 | 13.13 | **2963.14** |
| Plantation Horticulture | 1.10 | | 217.66 | 889.70 | | | | | | 3.64 | **1112.10** |
| Forest | | | 15.09 | | 3257.50 | | | | | 0.73 | **3273.32** |
| Forest Plantation | | | | | | | | | | | |
| Barren Rocky | | | | | | | 3.77 | | | | **3.77** |
| Scrub | 1.75 | 4.94 | 161.98 | 23.69 | | | | 554.24 | 0.60 | 5.11 | **752.31** |
| Waterbody-Streams/River | | | | | | | | | 24.59 | | **24.59** |
| Waterbody – Ponds | | | 11.40 | 0.59 | | | | | | 299.32 | **311.32** |
| Grand Total | **120.71** | **23.57** | **3065.27** | **1191.04** | **3257.50** | | **3.77** | **554.24** | **30.92** | **322.26** | **8569.27** |

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

• In T1 391 ha of the agriculture area has increased from mining/dump, plantations, forest, scrubland and water body of T2. The additional agriculture are coming from waterbody in T1 represents seasonal agriculture.

**Table showing change matrix depicting Land cover transitions 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 | 120.71 | | | | | | | | | | **120.71** |
| Mining/dump | | 23.57 | | | | | | | | | **23.57** |
| Agriculture | 3.06 | 0.28 | 3026.69 | 32.79 | | | | | | 2.45 | **3065.27** |
| Plantation Horticulture | 0.79 | 0.25 | 79.54 | 1110.18 | | | | | | 0.29 | **1191.04** |
| Forest | | | 0.42 | | 3256.99 | | | | | 0.09 | **3257.50** |
| Forest Plantation | | | | | | | | | | | |
| Barren Rocky | | | | | | | 3.77 | | | | **3.77** |
| Scrub | | 0.63 | 1.26 | | | | | 521.85 | 30.33 | 0.17 | **554.24** |
| Waterbody-Streams/River | | | | | | | | | 30.92 | | **30.92** |
| Waterbody – Ponds | | | | | | | | | | 322.26 | **322.26** |
| **Grand Total** | **124.56** | **24.73** | **3107.91** | **1142.97** | **3256.99** | | **3.77** | **521.85** | **61.24** | **325.26** | **8569.27** |

- 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 38 ha of the agriculture area has decreased and it is converted into Built-up, mining/dump, plantations and water body in T2.
- In T2 80 ha of the agriculture area has increased from plantations , 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-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 | 124.56 | | | | | | | | | | **124.56** |
| Mining/dump | | 24.73 | | | | | | | | | **24.73** |
| Agriculture | 4.41 | 0.67 | 2860.82 | 240.28 | | | | | | 1.73 | **3107.91** |
| Plantation Horticulture | 0.60 | | 122.67 | 1019.65 | | | | | | 0.05 | **1142.97** |
| Forest | | | 7.37 | | 3247.01 | 2.60 | | | | | **3256.99** |
| Forest Plantation | | | | | | | | | | | |
| Barren Rocky | | | | | | | 3.77 | | | | **3.77** |
| Scrub | 0.61 | 6.19 | 16.99 | 0.58 | | | | 497.43 | | 0.05 | **521.85** |
| Waterbody-Streams/River | | | | | | | | | 61.24 | | **61.24** |
| Waterbody – Ponds | | | 1.20 | | | | | | | 324.05 | **325.26** |
| Grand Total | **130.18** | **31.59** | **3009.06** | **1260.51** | **3247.01** | **2.60** | **3.77** | **497.43** | **61.24** | **325.89** | **8569.27** |

- 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 247 ha of the agriculture area has decreased and it is converted into Built-up, mining/dump, plantations and water body in T3.
- In T3 148 ha of the agriculture area has increased from plantations, forest, 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-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 | 130.18 | | | | | | | | | | **130.18** |
| Mining/dump | | 31.56 | | | | | | | | 0.03 | **31.59** |
| Agriculture | 0.06 | 0.37 | 2988.35 | 12.77 | | | | | | 7.51 | **3009.06** |
| Plantation Horticulture | | | 71.52 | 1188.47 | | | | | | 0.51 | **1260.51** |
| Forest | | | 2.87 | | 3242.57 | | | | | 1.56 | **3247.01** |
| Forest Plantation | | | | | | 2.60 | | | | | **2.60** |
| Barren Rocky | | | | | | | 3.77 | | | | **3.77** |
| Scrub | 0.53 | 0.71 | 25.97 | 0.52 | | | | 464.53 | 4.27 | 0.90 | **497.43** |
| Waterbody-Streams/River | | | | | | | | | 61.24 | | **61.24** |
| Waterbody – Ponds | | | 0.57 | | | | | | | 325.32 | **325.89** |
| **Grand Total** | **130.78** | **32.63** | **3089.28** | **1201.76** | **3242.57** | **2.60** | **3.77** | **464.53** | **65.51** | **335.83** | **8569.27** |

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

•In T4 100 ha of the agriculture area has increased from plantations, 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-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 | 130.42 | | | | | | | | | | **130.42** |
| Mining/dump | | 32.65 | | | | | | | | | **32.65** |
| Agriculture | | | 2976.9 | 87.94 | | | | | 11.94 | 2 | **3078.78** |
| Plantation Horticulture | | | | 1207.7 | | | | | 2.19 | | **1209.89** |
| Forest | | | | | 3238.77 | | | | 2.77 | 0.7 | **3242.24** |
| Forest Plantation | | | | | | 2.6 | | | | | **2.6** |
| Barren Rocky | | | | | | | 3.77 | | | | **3.77** |
| Scrub | | | | 5 | | | | 458.42 | 2.52 | 0.88 | **466.82** |
| Waterbody-Streams/River | | | | | | | | | 252.16 | | **252.16** |
| Waterbody – Ponds | | | | | | | | | | 150.13 | **150.13** |
| **Grand Total** | **130.42** | **32.65** | **2976.9** | **1300.64** | **3238.77** | **2.6** | **3.77** | **458.42** | **271.58** | **153.71** | **8569.46** |

- 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 101 ha of the agriculture area has decreased and it is converted into plantations and water body in 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 88 Hectares in Reservoir / Tanks area as compared between baseline LU/LC data 2012-13 (T0) & 2020-21 (T5) years.
4. There is an increase of 102, 42 & 80 Hectares from T0-T1, T1-T2 & T3-T4, there is a decrease of 98 & 101 Hectares from T2-T3 & T4-T5 and overall increase of 13 Hectares in Crop land area as compared between baseline LU/LC data 2012-13 (T0) & 2020-21 (T5) years.
5. About **189 Hectares of plantation/horticulture area has been increased** in during the monitoring period of 2012-13 (T0) & 2020-21 (T5) years.
6. There is a decrease of 294 Hectares in Scrubland area as compared between 2012-13 (T0) & 2020-21 (T5) years.
7. Farm ponds (13) is visible on IWMP Bhuvan Srishti portal out of Bhuvan Drishti photo of Farm ponds (13) verified from the portal.