Land and Property
MODERNIZATION OF LAND ADMINISTRATION & IT'S SOCIO-ECONOMIC IMPACT
18-19 OCTOBER 2023

Leveraging Geospatial Technologies for
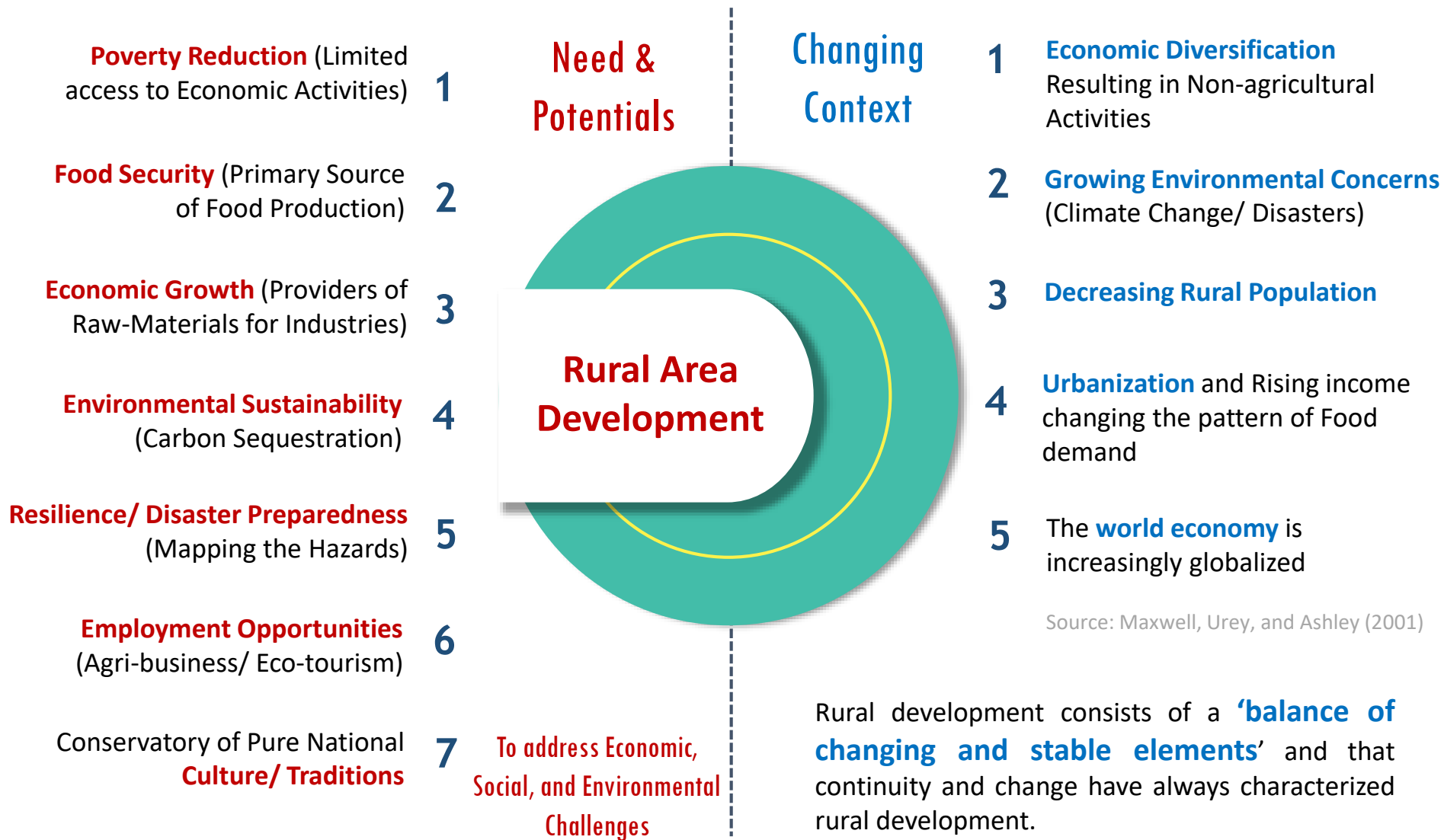**Sustainable Rural Land Use Planning & Development**

Dr. Sameer M. Deshkar
Associate Professor
Dept. of Architecture & Planning
Visvesvaraya National Institute of Technology, Nagpur

Need & Potentials

1 **Poverty Reduction** (Limited access to Economic Activities)

2 **Food Security** (Primary Source of Food Production)

3 **Economic Growth** (Providers of Raw-Materials for Industries)

4 **Environmental Sustainability** (Carbon Sequestration)

5 **Resilience/ Disaster Preparedness** (Mapping the Hazards)

6 **Employment Opportunities** (Agri-business/ Eco-tourism)

7 Conservatory of Pure National **Culture/ Traditions**

To address Economic, Social, and Environmental Challenges

Rural Area Development

Changing Context

1 **Economic Diversification** Resulting in Non-agricultural Activities

2 **Growing Environmental Concerns** (Climate Change/ Disasters)

3 **Decreasing Rural Population**

4 **Urbanization** and Rising income changing the pattern of Food demand
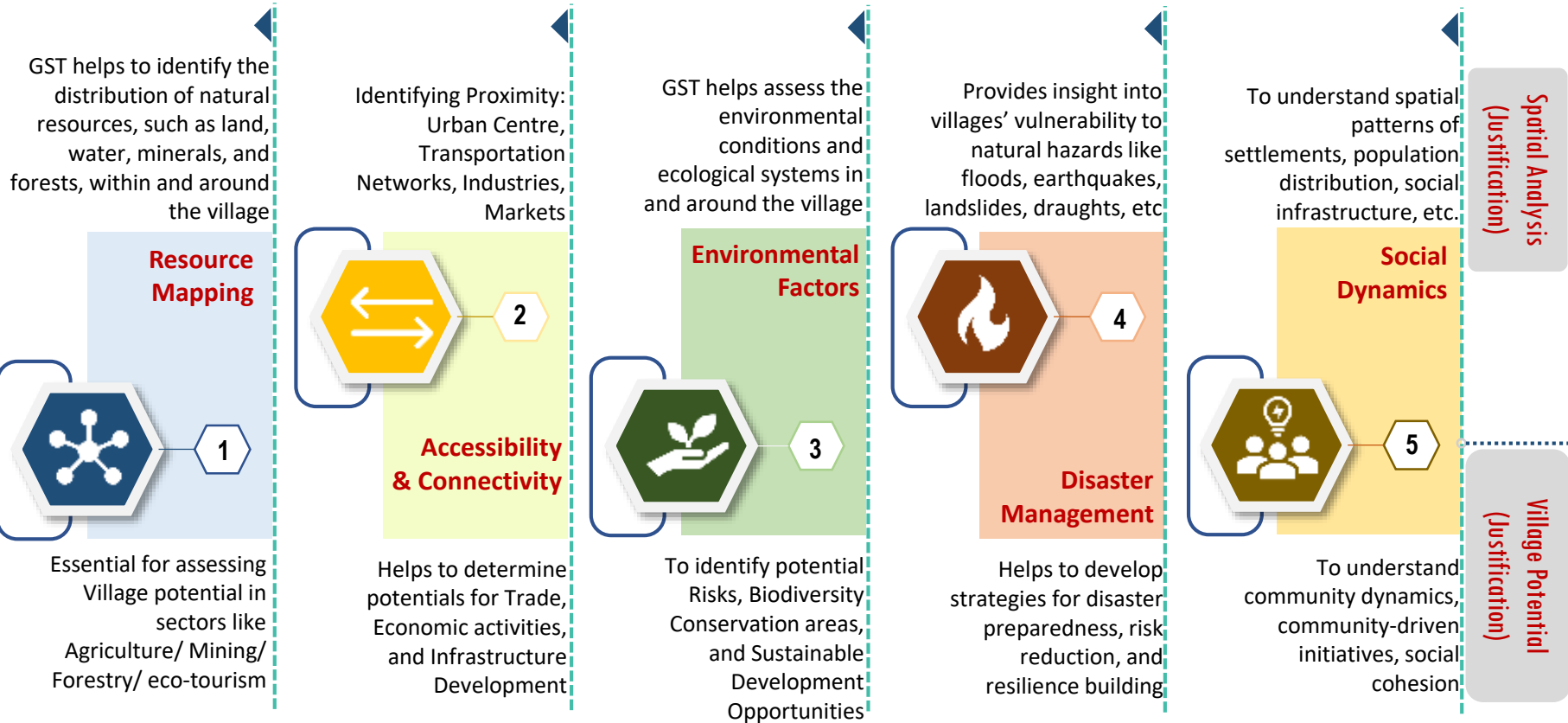
5 The **world economy** is increasingly globalized

Source: Maxwell, Urey, and Ashley (2001)

Rural development consists of a **'balance of changing and stable elements'** and that continuity and change have always characterized rural development.

- Van der Ploeg (1998)

Geospatial Technology &
Land Management

GST helps to identify the distribution of natural resources, such as land, water, minerals, and forests, within and around the village

Resource Mapping

1

Essential for assessing Village potential in sectors like Agriculture/ Mining/ Forestry/ eco-tourism

Identifying Proximity: Urban Centre, Transportation Networks, Industries, Markets

2

Accessibility & Connectivity

Helps to determine potentials for Trade, Economic activities, and Infrastructure Development

GST helps assess the environmental conditions and ecological systems in and around the village

Environmental Factors

3

To identify potential Risks, Biodiversity Conservation areas, and Sustainable Development Opportunities

Provides insight into villages' vulnerability to natural hazards like floods, earthquakes, landslides, draughts, etc

4

Disaster Management

Helps to develop strategies for disaster preparedness, risk reduction, and resilience building

To understand spatial patterns of settlements, population distribution, social infrastructure, etc.

Social Dynamics

5

To understand community dynamics, community-driven initiatives, social cohesion

Spatial Analysis (Justification)

Village Potential (Justification)

Role of Geospatial Technology (GST) in Land Management

For Monitoring & Evaluation: Providing real-time data and Spatial Analysis

R e g I o n a l   C h a r a c t e r I s t I c s

Regional Setting & Administrative boundary

Ramtek Tehsil of Nagpur district showing Mansar village.
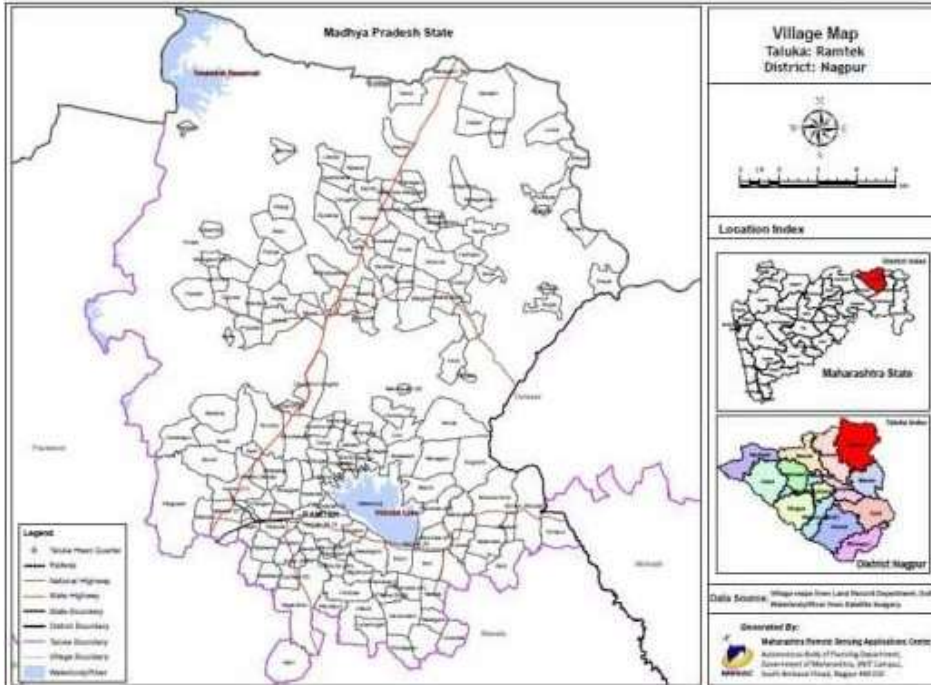
Source: RRSC-central,NRSC, ISRO, Nagpur a n d MRSAC


Basemap of Mansar
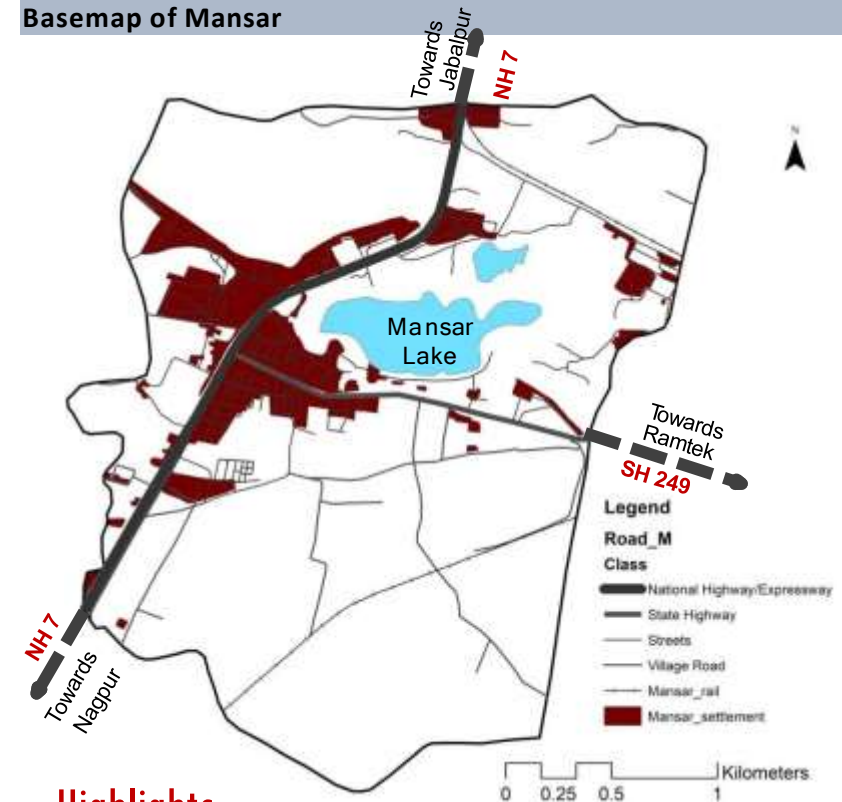
Highlights

- Mansar is the **2nd most populous village**, located in the Ramtek sub-district of Nagpur district in the state of Maharashtra, Bharat.
- Mansar has a **Population of 7139 with a Population Density of 1019 persons per sqKm**
- **Total Geographical area** of Mansar village is **7 sqkm/ 712ha**
- **20th biggest village** by area in the sub-district.
- Having archeological remains and many temples

STUDY AREA: M A N S A R

R e g i o n a l   C h a r a c t e r I s t I c s

Existing Structures

Drainage Map of Mansar
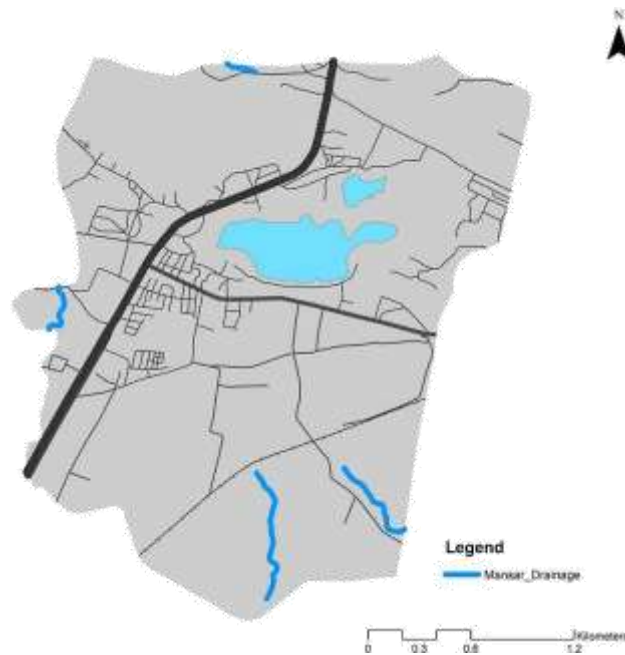
Physiography

Source: RRSC-central,NRSC, ISRO, Nagpur
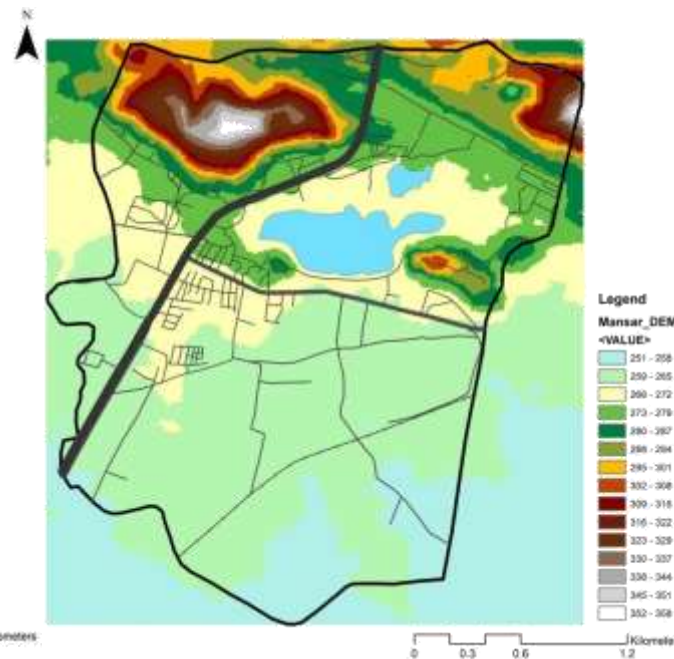
Map showing DEM of Mansar
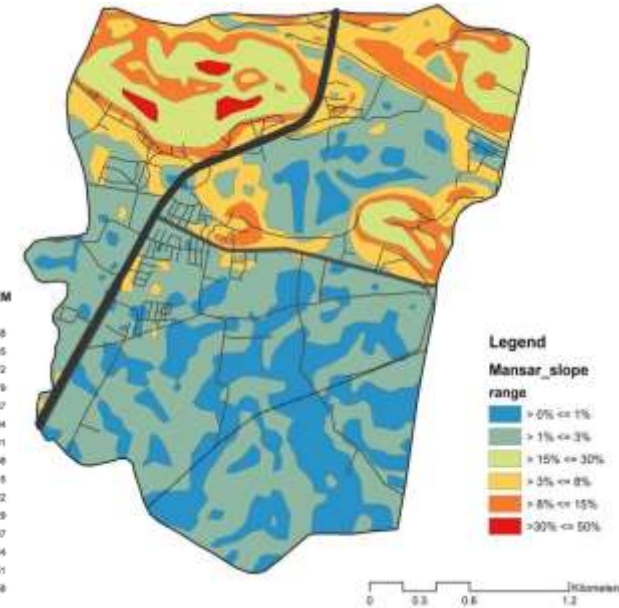
Map showing Slope of Mansar

TOPOGRAPHY
The elevation ranges from about 253m above msl to about 357m msl.

SLOPE: There is steep slope towards Forest area in the northwest, a moderate slope near the mine in the northeast and near Mansar lake, and near to level slope in the habitation mask.a Lake

STUDY AREA: M A N S A R

R e g i o n a l   C h a r a c t e r i s t i c s

Existing Features

Soil Conditions

Source: RRSC-central,NRSC, ISRO, Nagpur
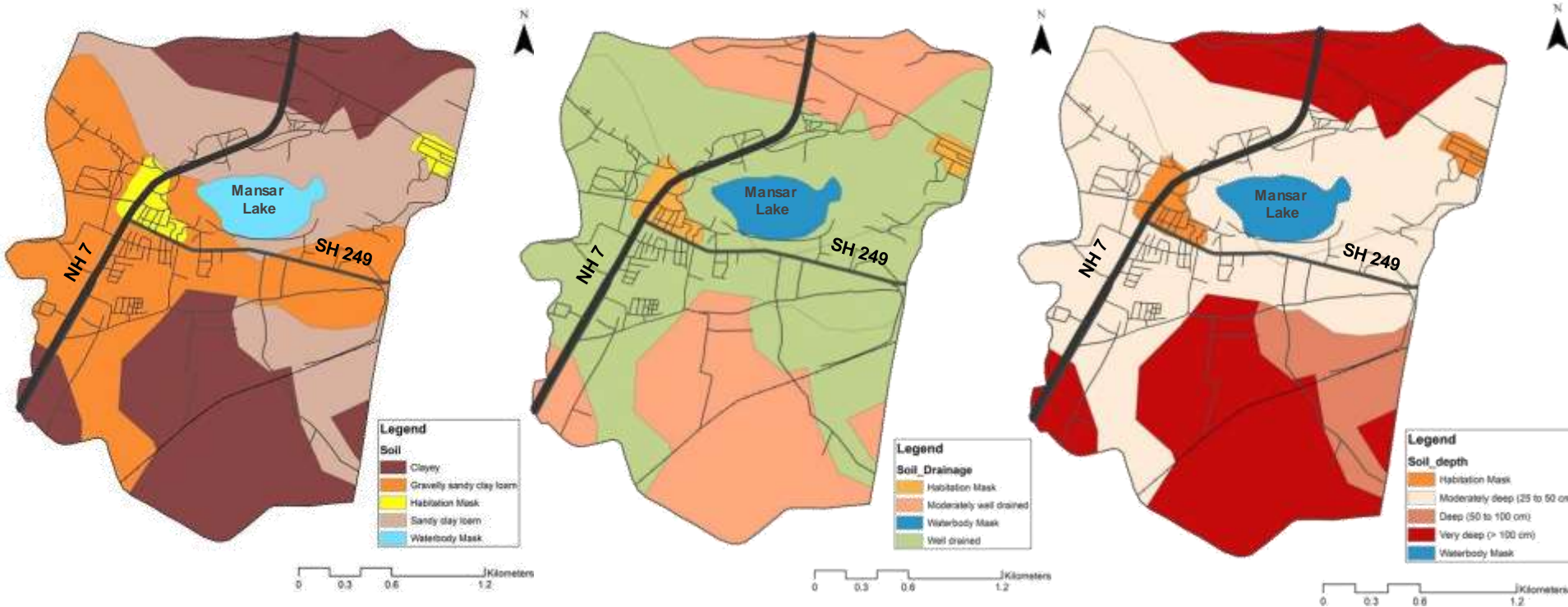
SOIL CONDITION

Along NH7 and SH249, and Mansar lake, the soil type is Gravelly sandy and Clay loam. The soil type is well-drained and has a moderate depth of 25 to 50 cm.

STUDY AREA: M A N S A R

R e g i o n a l   C h a r a c t e r i s t i c s

Existing Features

Geomorphology

Source: RRSC-central,NRSC, ISRO, Nagpur

Legend
L2
- Anthropogenic Terrain
- Moderately Dissected Hills & Valleys
- Pediment Pediplain Complex
- Pond

Legend
L1
- Anthropogenic Origin
- Denudational Origin
- Structural Origin
- Water Bodies
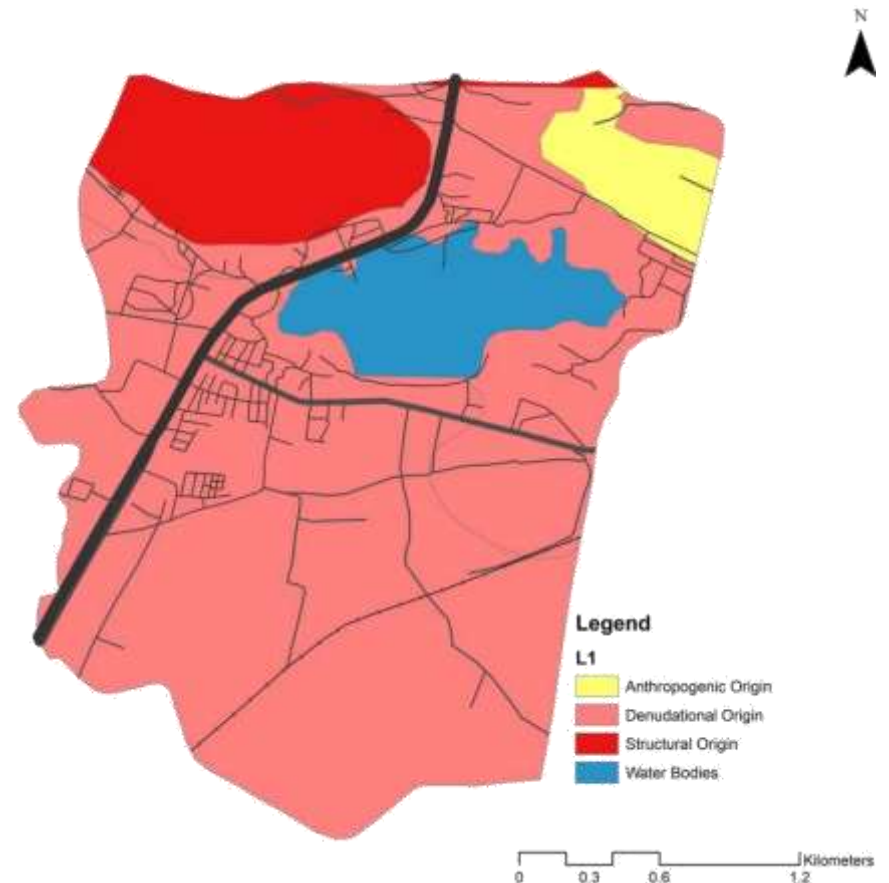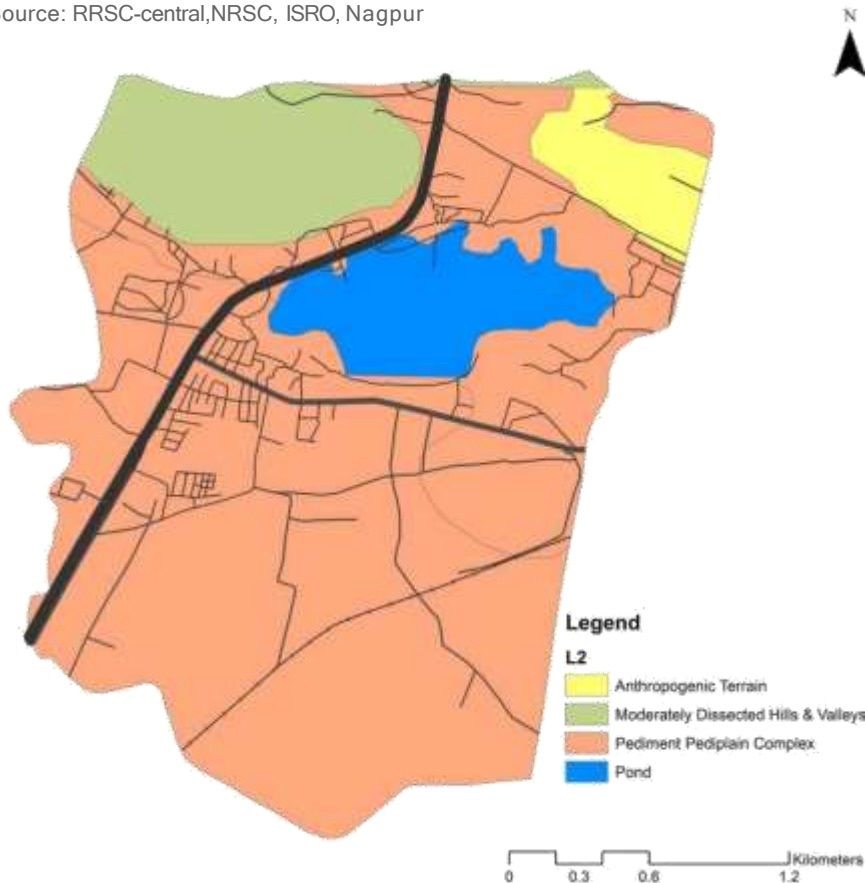
GEOMORPHOLOGY

The habitation mask comes in denudational origin and Pediment Pediplain complex type.
Forest area is of structural origin and the Mine are is of Anthropogenic origin.

P o p u l a t i o n   C h a r a c t e r i s t i c s

Census Data and Household survey Data

Demographic profile and Population Density (Net and Gross)

- The Mansar village is home to 7139 people, among them 3536 (50%) are male and 3603 (50%) are female.
- 60% of the whole population are from general caste, 20% are from schedule caste and 20% are schedule tribes.
- The child population (aged under 6 years) of Mansar CT is 10%, among them 54% are boys and 46% are girls.
- There are a total of 1639 households in the village and an average of 4.3 persons live in every family.
- Area of GP is 638 ha. The Gross population density is 11.18 %

Population growth (Natural growth and Migration Patterns)

- Population of the Mansar CT has increased by 11% in the last 10 years
- The female population growth rate of the village is 12% which is 3% higher than the male population growth rate of 9%.

Literacy and Age-Sex Composition

- A total of 5342 people in the village are literate, among them 2760 are male and 2582 are female. Overall the literacy rate is 75%
- As of the 2011 census, there are 1018 females per 1000 males in the village.

Source: Census 2011 and Household Survey

Caste population distribution

Religion trends in Mansar
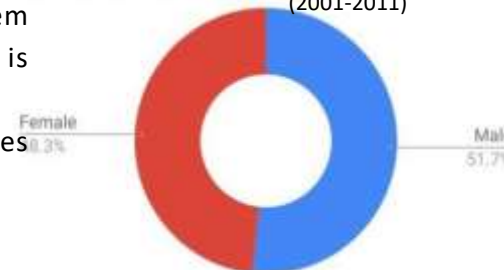
As per HH survey,Majority of the people are Hindu, followed by Buddhism, Islam and Christianity
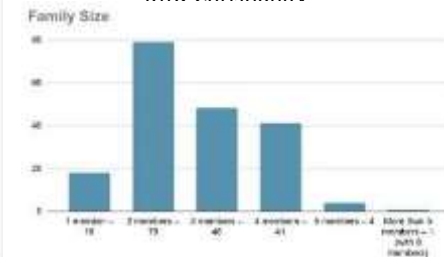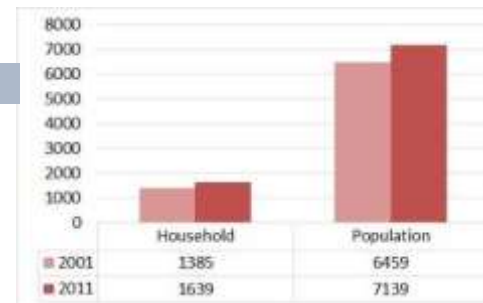
Decadal growth of population (2001-2011)

General family size is observed to be 2 – 3 members per family.
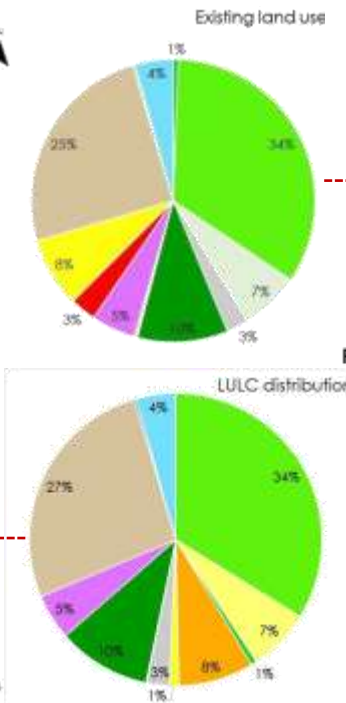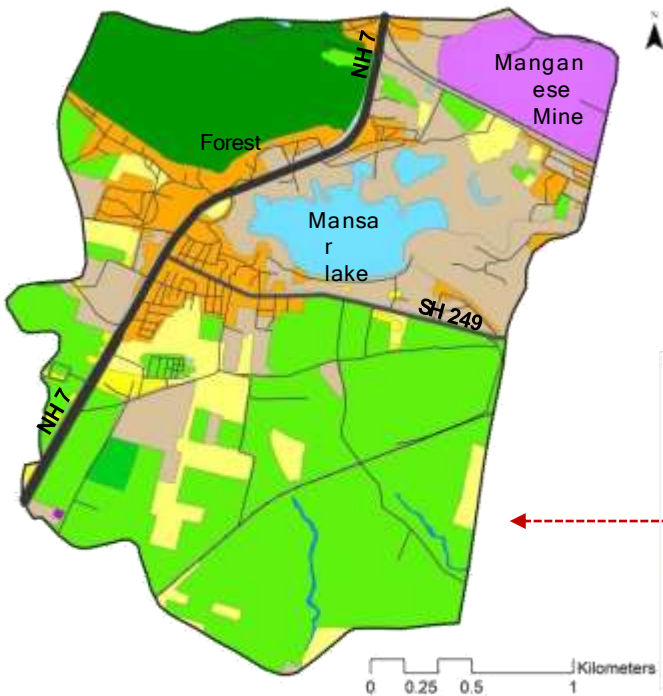

Male Female literacy in %

Male Female ratio

E x I s t I n g   S c e n a r I o

Land use Land cover

Total Agricultural land area is 42%, total Built-Up area is 9%, Forest area is 10%, Mining is 5%, Scrub land is 27%, water body is 4% and transportation is 3%
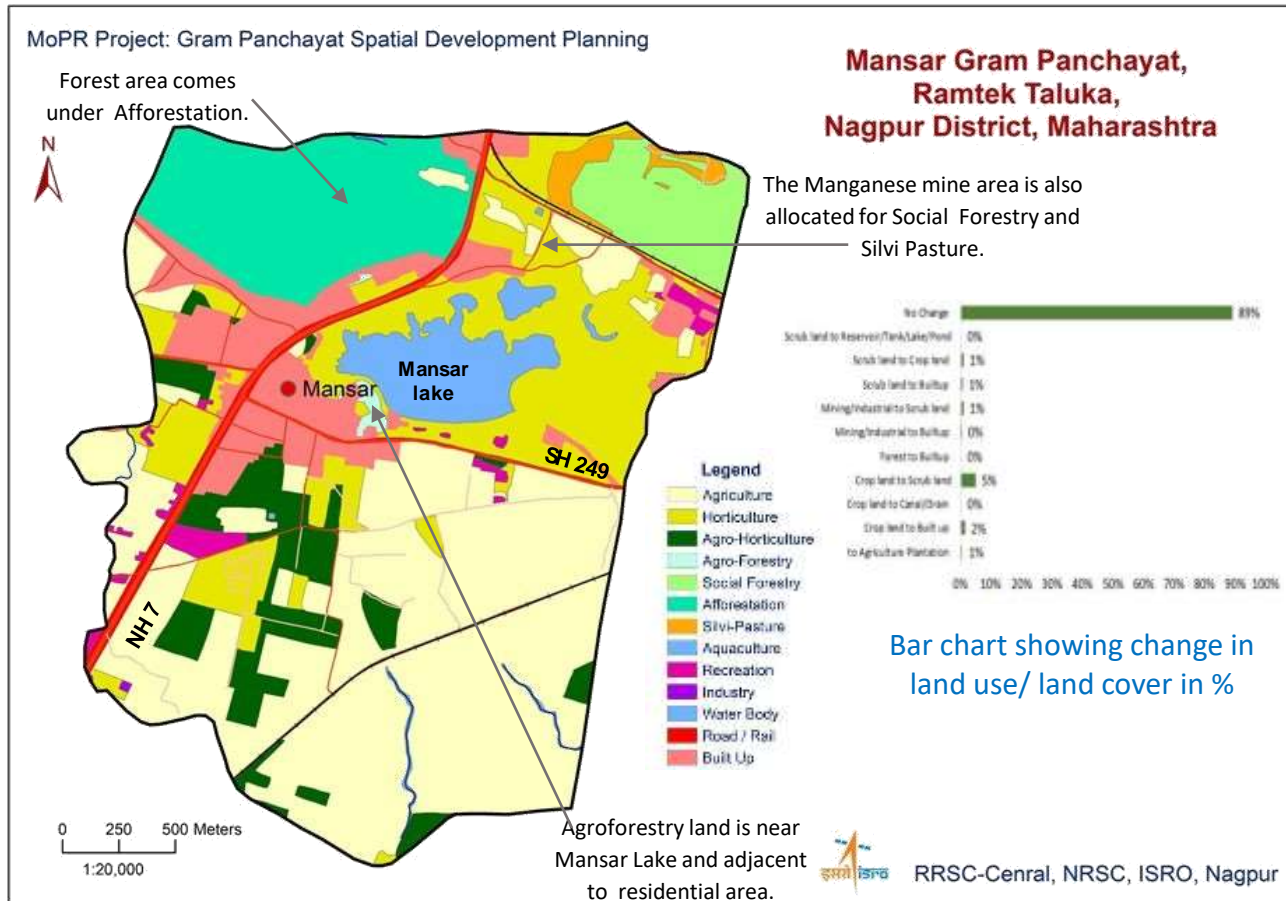
Source: RRSC-central, NRSC, ISRO, Nagpur

STUDY AREA: M A N S A R

E x I s t I n g   S c e n a r I o

2011

Forest

Manganese Mine

Mansar Lake

NH 7

SH 249

2018

Forest

Manganese Mine

Mansar Lake

NH 7

SH 249

Map showing change in land use/ land cover from 2011-2018

Land Resource Development Plan Map

MoPR Project: Gram Panchayat Spatial Development Planning

Forest area comes under Afforestation.

Mansar Gram Panchayat, Ramtek Taluka, Nagpur District, Maharashtra

The Manganese mine area is also allocated for Social Forestry and Silvi Pasture.

Mansar

Mansar lake

SH 249

NH 7

Legend
- Agriculture
- Horticulture
- Agro-Horticulture
- Agro-Forestry
- Social Forestry
- Afforestation
- Silvi-Pasture
- Aquaculture
- Recreation
- Industry
- Water Body
- Road / Rail
- Built Up

Bar chart showing change in land use/ land cover in %

Agroforestry land is near Mansar Lake and adjacent to residential area.

0   250   500 Meters
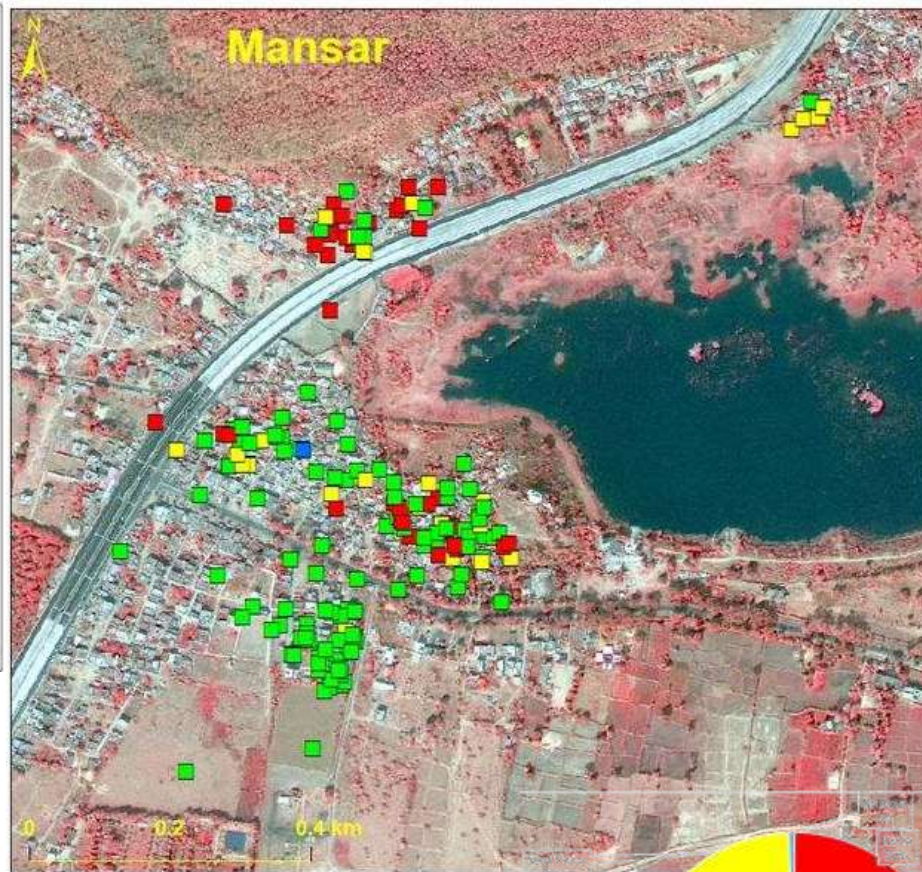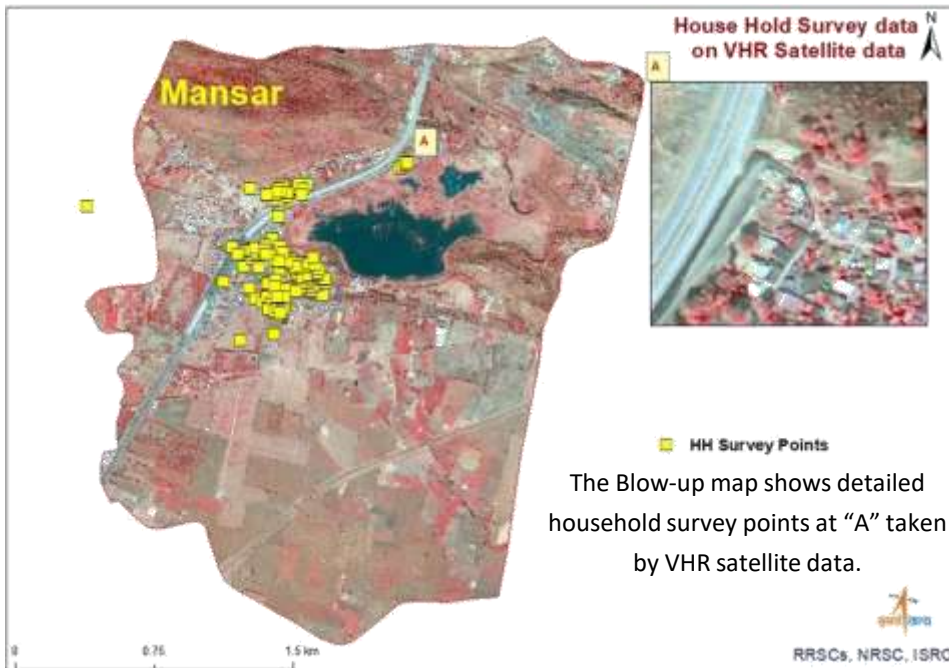
1:20,000

RRSC-Central, NRSC, ISRO, Nagpur

Source: RRSC-central, NRSC, ISRO, Nagpur

Development trends

- The development trend is along the NH7, near forest and Mansar lake.
- Overall there is no significant change in land use from 2011-2018.

STUDY AREA: M A N S A R

H O U S I N G

House Hold Survey data on VHR Satellite data

☐ HH Survey Points

The Blow-up map shows detailed household survey points at "A" taken by VHR satellite data.

RRSCs, NRSC, ISRO

- In Mansar, a total of 191 responses were recorded.
- The following map indicates Household survey points in Mansar.

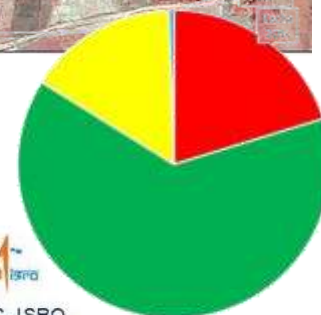### Household Survey data distribution based on House Type

Around 20% of the surveyed houses are Kacha while 16% are semi-pucca.

Most of the Kaccha houses are located along the North side of NH 44.

House Type
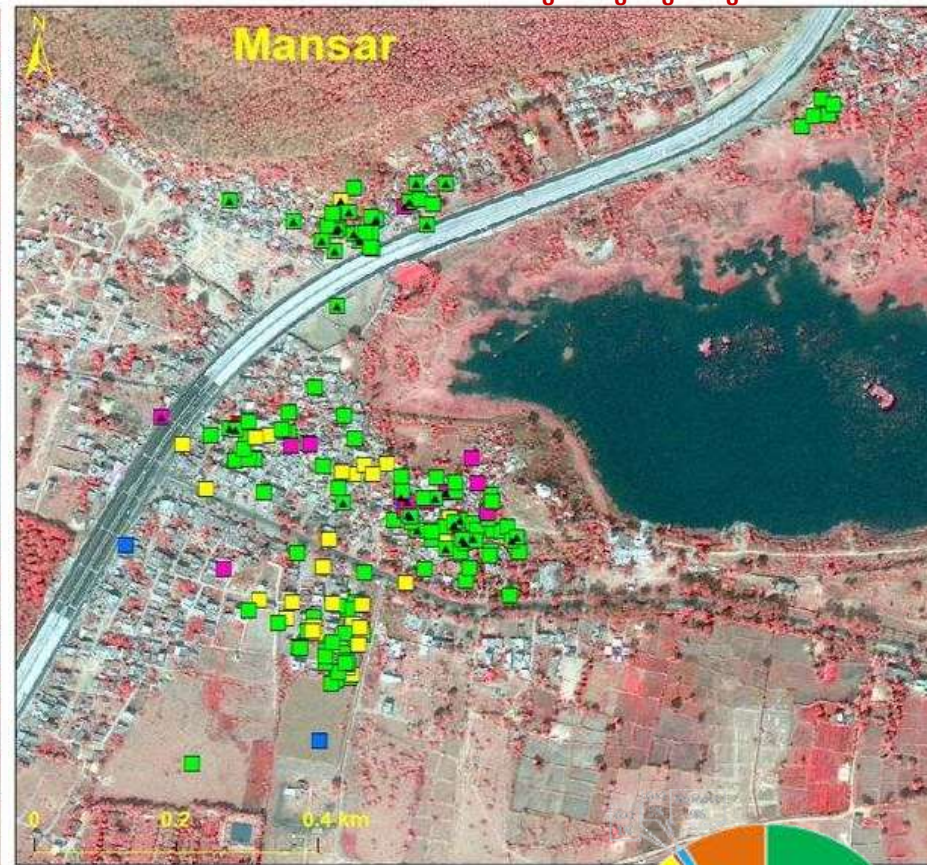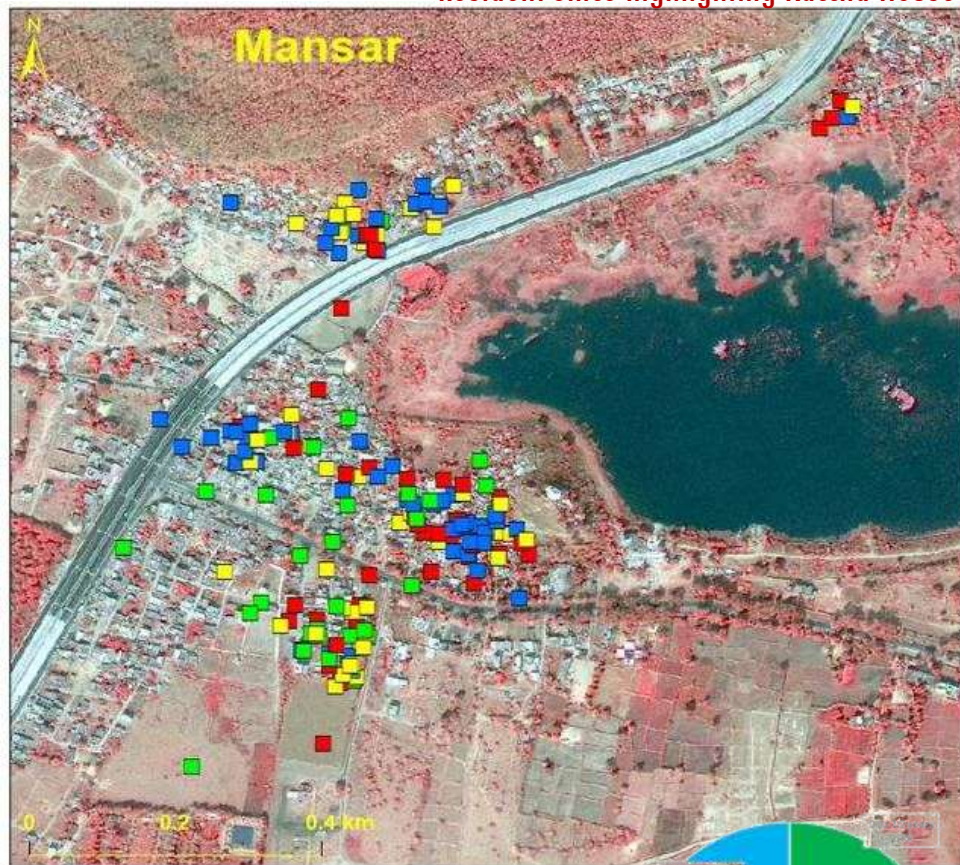- ■ Kachcha
- ■ Pucca
- ■ SemiPucca
- ■ No input

RRSCs, NRSC, ISRO

STUDY AREA: M A N S A R

H O U S I N G

Household Survey data distribution based on Resident Since highlighting Kaccha House
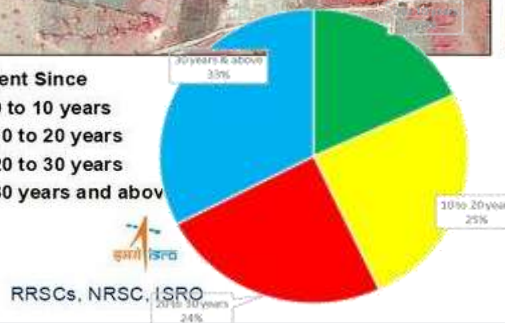
Household Survey data distribution based on House Height highlighting Kaccha House

A total 33% of the surveyed houses are native (30 years and above) while old buildings account for 7.3%. These old buildings are 50 years of age and above.
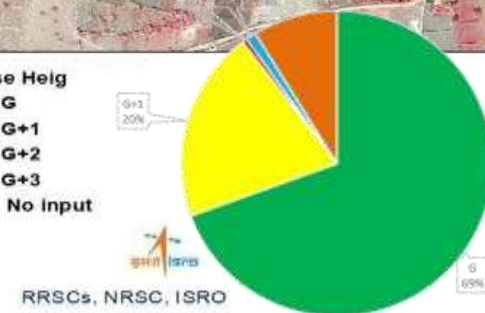
Resident Since
- 0 to 10 years
- 10 to 20 years
- 20 to 30 years
- 30 years and above

RRSCs, NRSC, ISRO

69% of the surveyed houses are ground floored. Followed by it, 20% are first floored.

House Heig
- G
- G+1
- G+2
- G+3
- No input

RRSCs, NRSC, ISRO
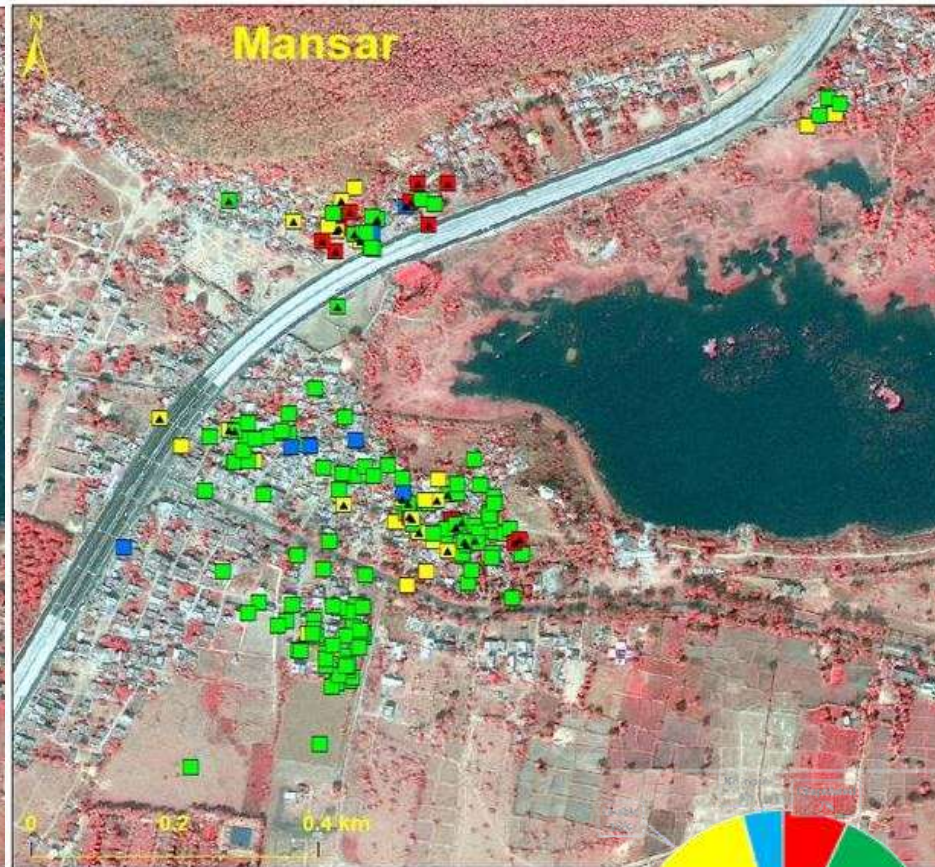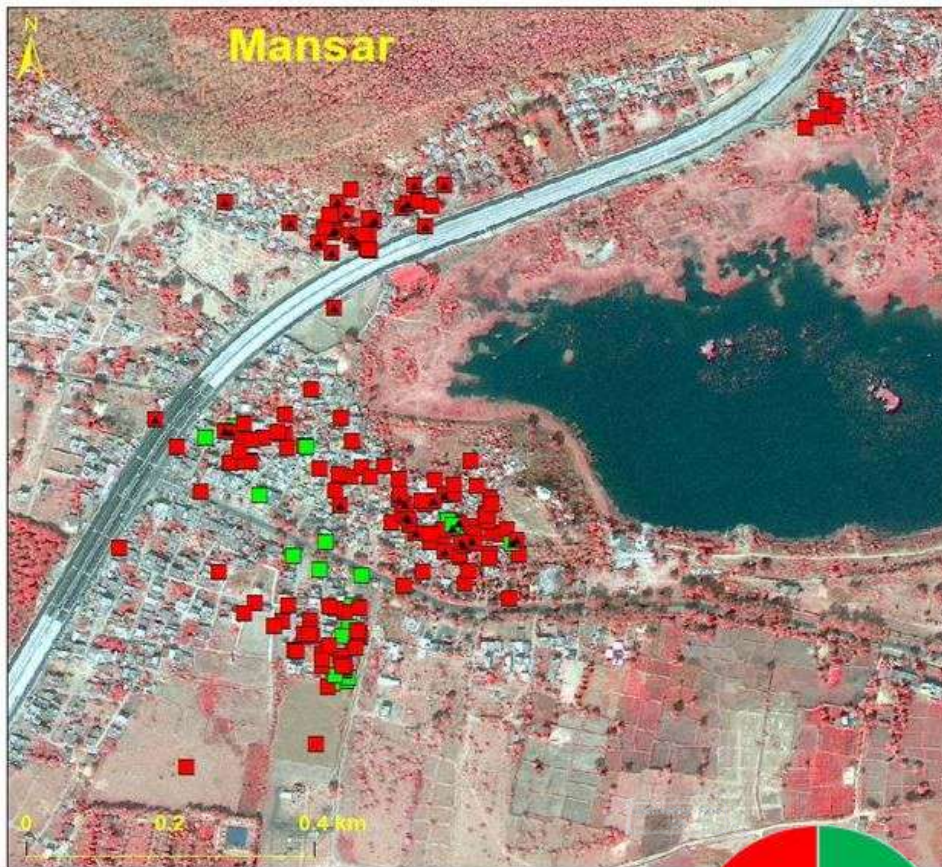
STUDY AREA: M A N S A R

H O U S I N G

**Household Survey data distribution based on Land Holding Highlighting Kaccha House**

Household Survey data distribution based on House condition highlighting Kacha House

A total of 85% of the surveyed houses have land-holding rights. The map's red squares with black triangles indicate Kacha houses with no land-holding rights. map's red squares with black triangles indicate total

Land Holding
- Land Holding - False
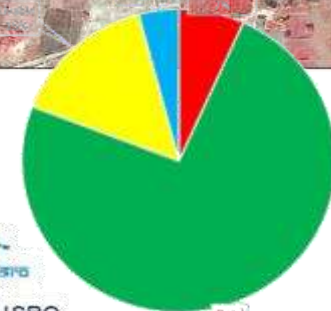- Land Holding - True
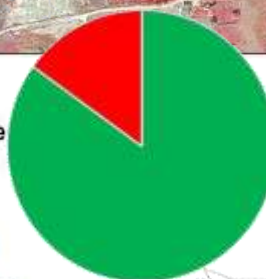
RRSCs, NRSC, ISRO

Most of the buildings are in good condition i.e. around 75%.

Only 6.8% are dilapidated.
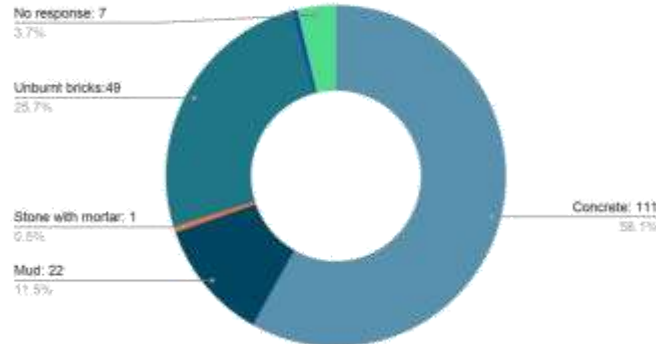
Condition
- Dilapidated
- Good
- Livable
- No input

RRSCs, NRSC, ISRO

H O U S I N G

Existing Conditions of Houses

Wall Material

- No response: 7 — 3.7%
- Unburnt bricks: 49 — 25.7%
- Stone with mortar: 1 — 0.5%
- Mud: 22 — 11.5%
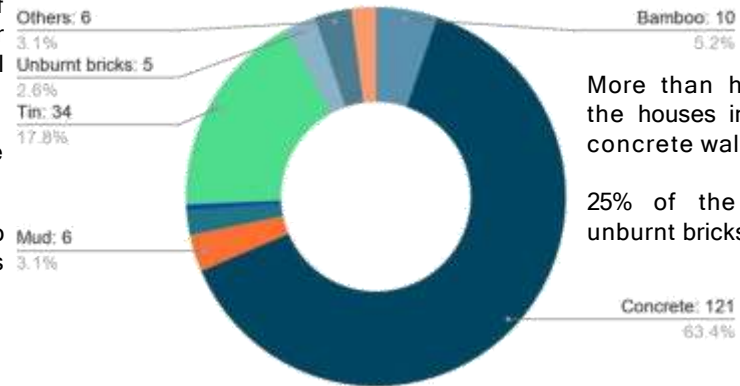- Concrete: 111 — 58.1%

More than half (58.1%) of the houses in Mansar have concrete wall material.

25% of the houses have unburnt bricks for walls.

Mud walls are also existent which constitutes 11.5% .

Roofing material

- Others: 6 — 3.1%
- Unburnt bricks: 5 — 2.6%
- Tin: 34 — 17.8%
- Bamboo: 10 — 5.2%
- Mud: 6 — 3.1%
- Concrete: 121 — 63.4%
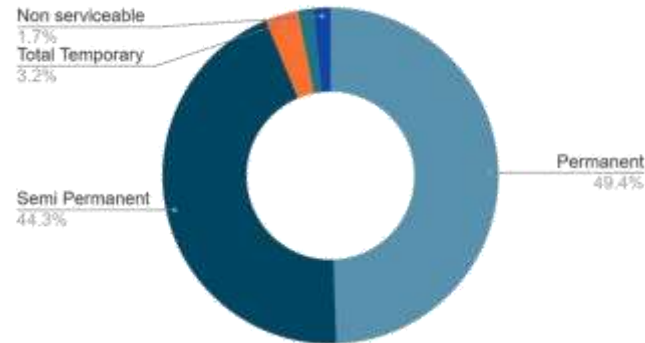
More than half (58.1%) of the houses in Mansar have concrete wall material.

25% of the houses have unburnt bricks for walls.

Households by type of structures by Census, 2011

- Non serviceable — 1.7%
- Total Temporary — 3.2%
- Semi Permanent — 44.3%
- Permanent — 49.4%

In order to upgrade the existing housing stock of Mansar, it is important to improve the dilapidated, non-serviceable, and Katcha structures.

Total Population (2011) = 6035

Population projection (2031) = 10228 Population

growth rate = 14.95% Household size = 4

Existing households (2011) = 1519

Number of households projected (2031) = Projected Population /

HH size = 10228/4 = **2557**

Total Households in "Good" condition = 828 Total

Households in "Livable" condition = 618

Total households in "Dilapidated" condition = 73

Total temporary structures = 50 Non
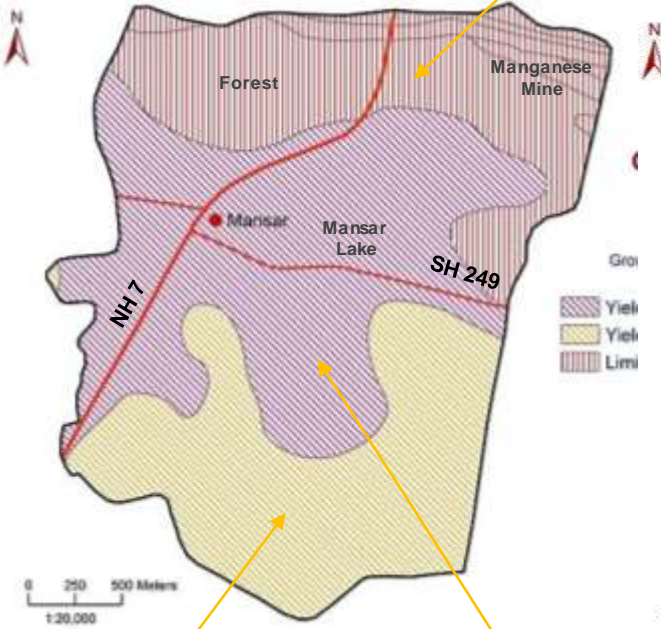
serviceable structures = 26

P h y s I c a l   I n f r a s t r u c t u r e

Water Resource Development Map

Ground Water Prospect Map

Source: RRSC-central,NRSC, ISRO, Nagpur

Area near the forest and mine has limited prospects area

The area under agriculture land has a yield range of 10-50 LPM and moderate groundwater depth i.e., 30-80m

The area near Mansar Lake and Habitation mask has a High yield range of groundwater i.e.,>800LPM

Legend
Ground Water Prospects in terms Yield and Depth

- Yield Range: > 800 LPM, Depth: Moderate 30-80m
- Yield Range: 10-50 LPM, Depth: Moderate 30 - 80m
- Limited Prospect; Depth: Deep >80m
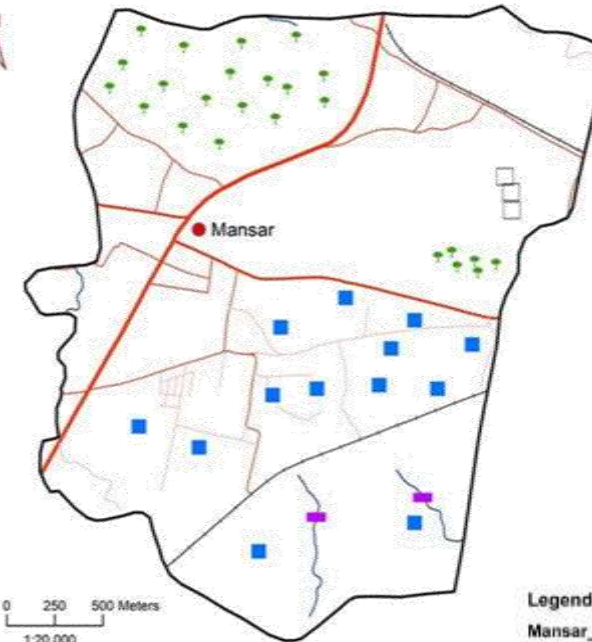
Legend
- Check Dam
- Farm Pond
- Afforestation
- Continuous Contour Trench
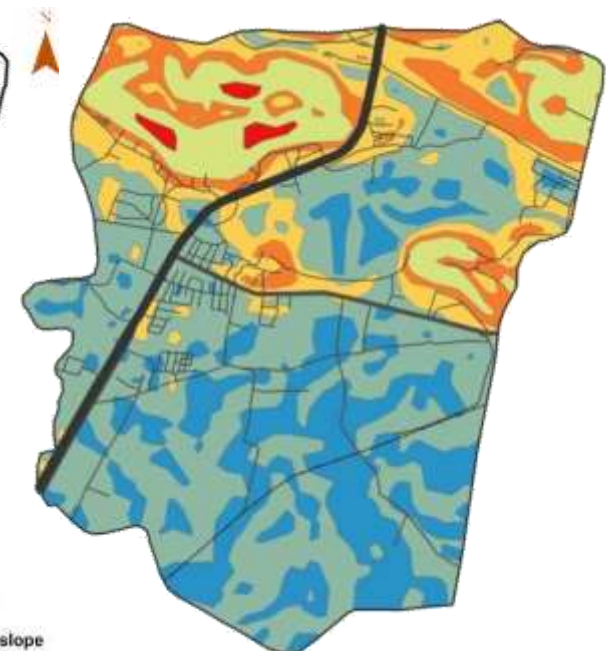
Legend
Mansar_slope range
- > 0% <= 1% — Level to nearly level
- > 1% <= 3% — Very gently sloping
- > 15% <= 30% — Gently sloping
- > 3% <= 8% — Moderately sloping
- > 8% <= 15% — Moderately steeply sloping
- >30% <= 50% — Steeply sloping

The Slope of Mansar village is from the Forest area and Mine area towards the Mansar lake, Habitation mask, and agricultural land. **This can help in the watershed management of the village**

Household Survey data distribution based on Water Supply availability Highlighting Kaccha House

Pie chart showing source of water supply in Mansar village

Source

Flowchart showing Source to supply connection at Mansar

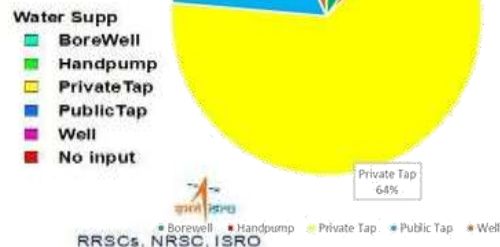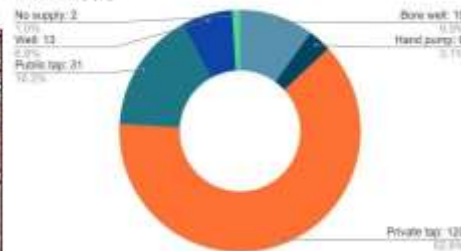| FUTURE DEMAND - WATER SUPPLY			
1	PER CAPITA WATER SUPPLY DEMAND	135	LPCD
2	WATER LOSSES	15	% ASSUMED
3	PER CAPITA WATER DEMAND (LPCD +%LOSS)	155.25	LPCD
4	PROJECTED POPULATION	11847	PERSON
	TOTAL DEMAND	1839246.75	LPD
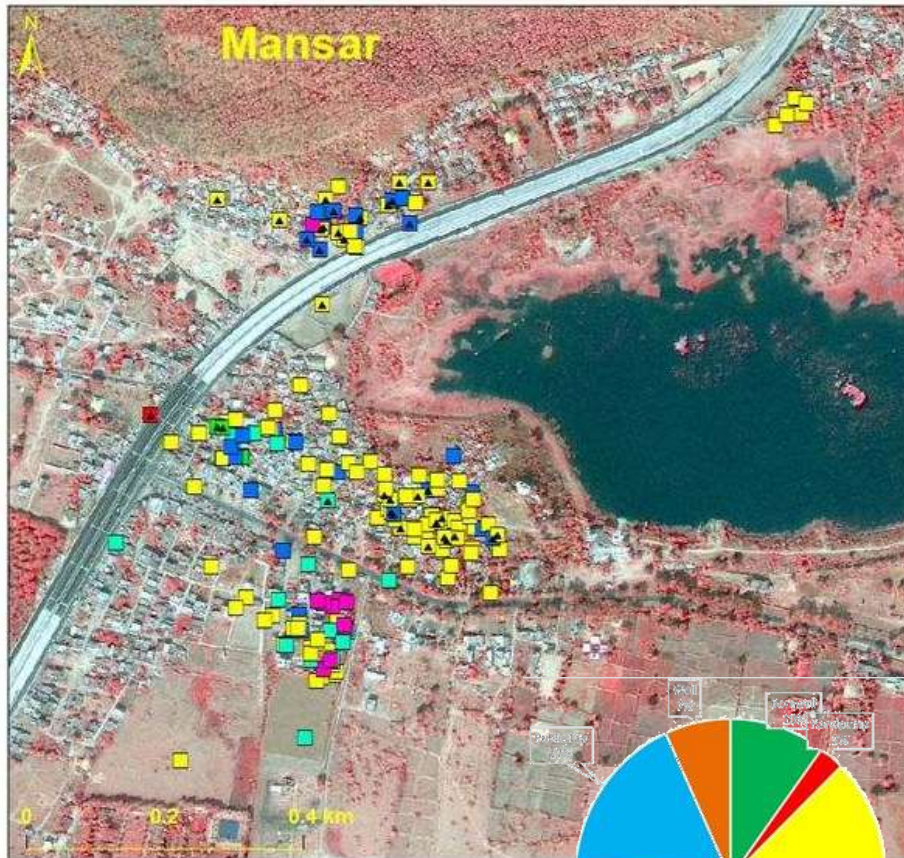
As per a household survey, only 64% i.e., 120 households have private tap connections. 17% i.e., 32 households use public taps. 10% i.e., 19 households have borewells.
7% i.e., 13 households have wells.
2-3 households use hand pumps as a mode of water supply.

Water Supp
- BoreWell
- Handpump
- Private Tap
- PublicTap
- Well
- No input

Private Tap 64%

Borewell   Handpump   Private Tap   Public Tap   Well
RRSCs, NRSC, ISRO

Connection
- More than 60% of households have private tap connections. Although the supply is for more than 2 hours daily.
- 17% of households use water from their private wells or borewells.
- 16.2% of households are dependent on public taps, whereas the distribution of public taps is uneven throughout the village.
- Few households do not have any kind of water supply near them or at their disposal. These households are dependent on neighbor's wells to satisfy their water demand.

Household Survey data distribution based on Toilet Type Highlighting Kaccha House

95% of the people own private toilets. Out of which 11% of the toilets are constructed under some scheme.
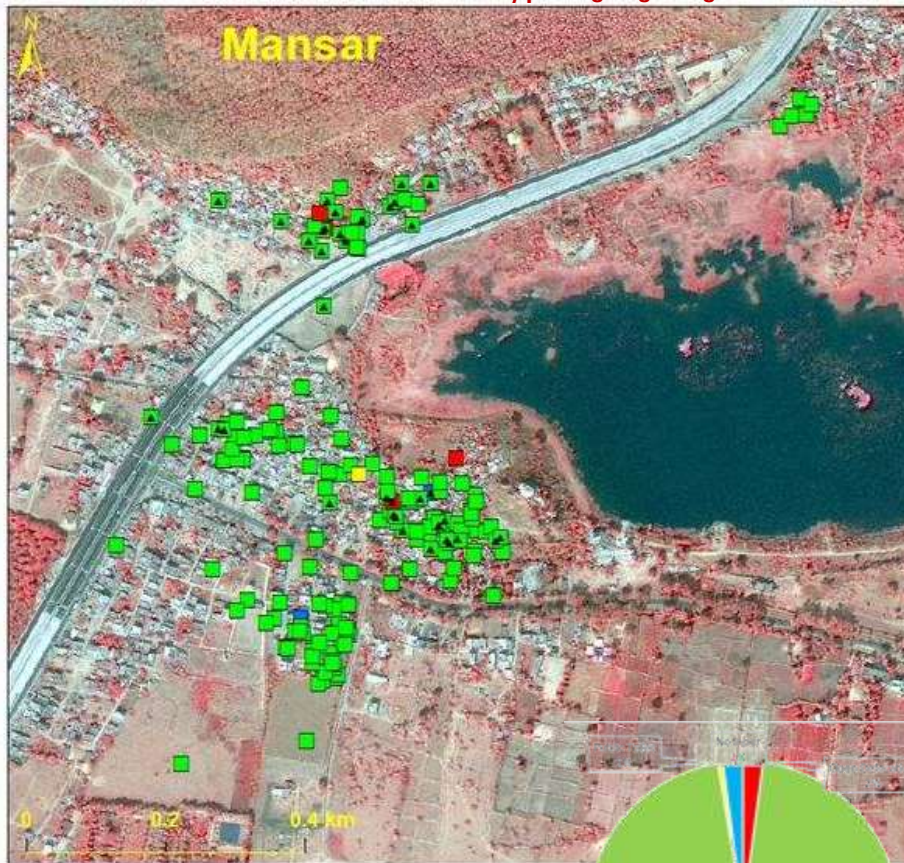
Toilet Type
- ■ OpenDefecation
- ■ Private
- ■ Public
- ■ No input

RRSCs, NRSC, ISRO
● Open Defecation ● Private Toilet ● Public Toilet ● No input

Private Toilet 95%

Solid Waste Management

Solid waste collection

No response: 3 — 1.8%
Open Dumping: 13 — 8.0%
Not available: 5 — 2.6%
Collection Cart: 170 — 89.0%
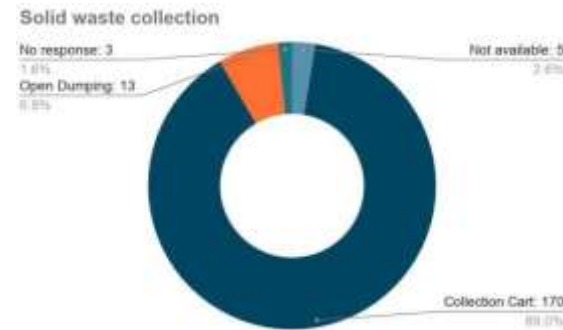
Pie chart showing SWM in Mansar village

Collection
As per the surveys it turned out around 89% of households are have door to door collection.

Treatment
There is not treatment facility available for the collected waste.

Dumping
The waste collected is dumped in the open.

- The waste collection efficiency is to be improved as there is still a gap in waste collection.

- Also the issue of open dumping needs to be addressed to avoid hazards to the environment as well as the inhabitants in the village area, including the livestock.

- There are areas that still have no waste collection facility.

- There is no treatment facility for the collected waste whatsoever. The collected waste is dumped in an open ground near the village. Thus a proper treatment facility like a composting and recycling plant is necessary.

Projected Waste Generation for Population (Mansar)

Year	2021	2031	2041
Population	8245	9864	11847
Waste Generation @ 0.175 kg/cap/day			
Waste Generation	1442.88	1726.20	2073.23

P h y s I c a l   I n f r a s t r u c t u r e

Transportation

Fundamental Issues

1. Sudden growth in certain areas makes it difficult to keep up with **maintenance**.
2. Lack of **funding for capacity improvements** to roads where traffic growth warrants improvements
3. **Inadequate public transportation** choices to accommodate travel demand growth or job access

Observations from field survey:
More than 50% of transport needs are catered through personal 2-wheelers

Conclusion: Plans must address the issue of supporting economic growth and development

Sources: Esri, HERE, Garmin, Intermap, increment P Corp., GEBCO, USGS, FAO, NPS

Legend

Cluster_AOI

Mansar_Cluster_Villages_Boundary
Gram_Panchayat

- Bhilewada (1)
- Borda (4)
- Chargaon (2)
- Kandri (3)
- Khairi (1)
- Khumari (2)
- Mansar (1)
- Patgowari (2)
- Pindkapur (1)
- Soneghat (1)
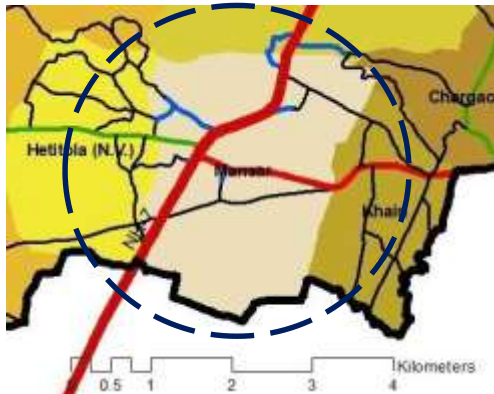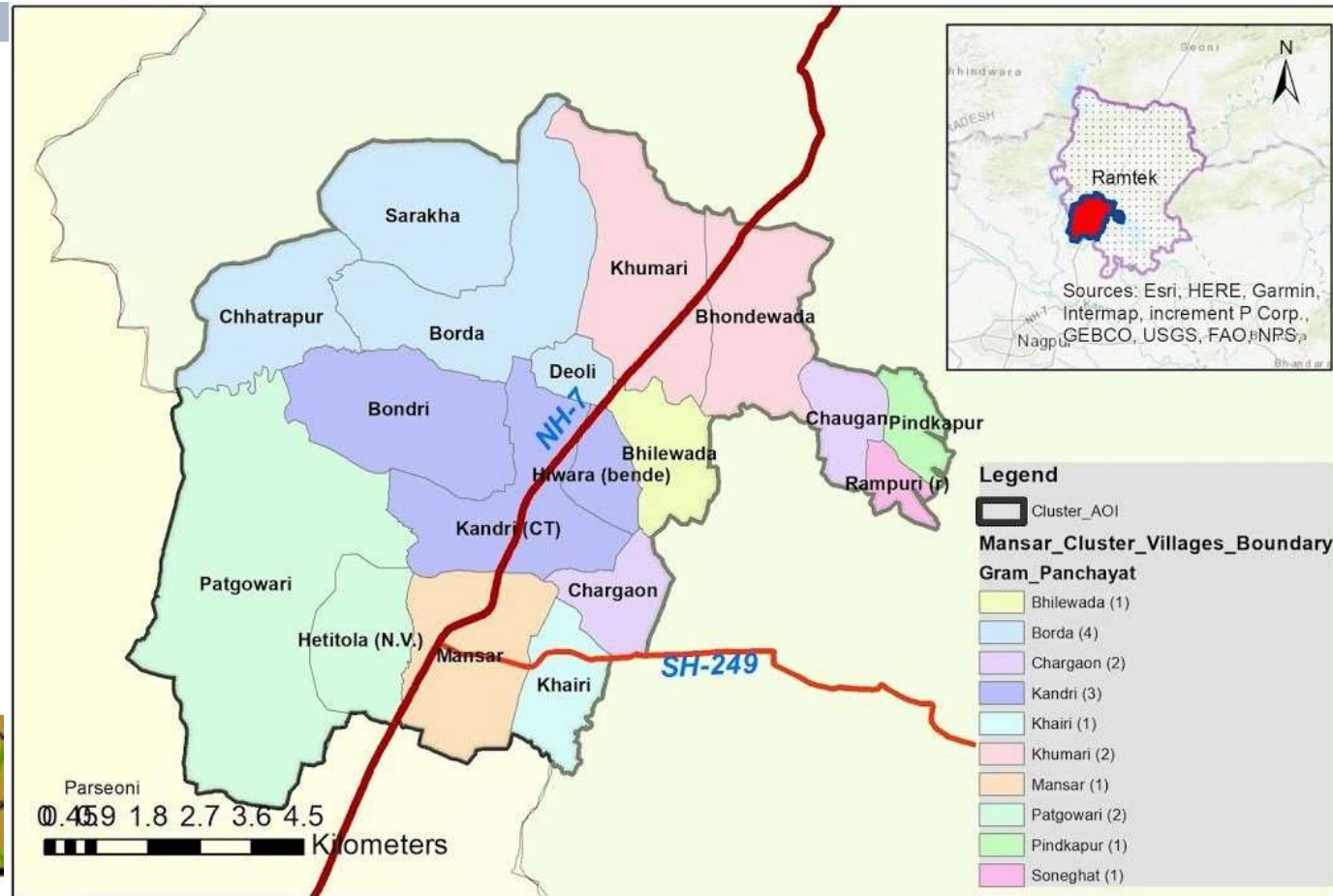
P R O P O S A L

Housing

Improving the existing housing stock of dilapidated and non-serviceable kaccha houses.

Pradhan Mantri Gramin Awaas Yojana (PMGAY) is a social welfare program to provide housing for the rural poor in India. The broad purpose of the scheme is to provide financial assistance to some of the weakest sections of society for them to upgrade or construct a house of respectable quality for their personal living. The vision of the government is to replace all temporary (kutcha) houses in Indian villages.

Under this scheme, the upgradation of dilapidated and non-serviceable kaccha houses can be undertaken.

Scope for future development of housing

As per the previous development trends, it is observed that the expansion of Mansar is along the National Highway (NH 7) passing through it from North to South and along the State Highway (SH 249).

The red dots in the following map show the possible scope for future development. According to land capability studies, the soils at these places have severe limitations that reduce the choice of plants or require special conservation practices.

Legend
Road_M
Class
National Highway/Expressway
State Highway
Streets
Village Road
Mansar_rail
Mansar_settlement
Future development

0   0.25   0.5   1   Kilometers

P R O P O S A L
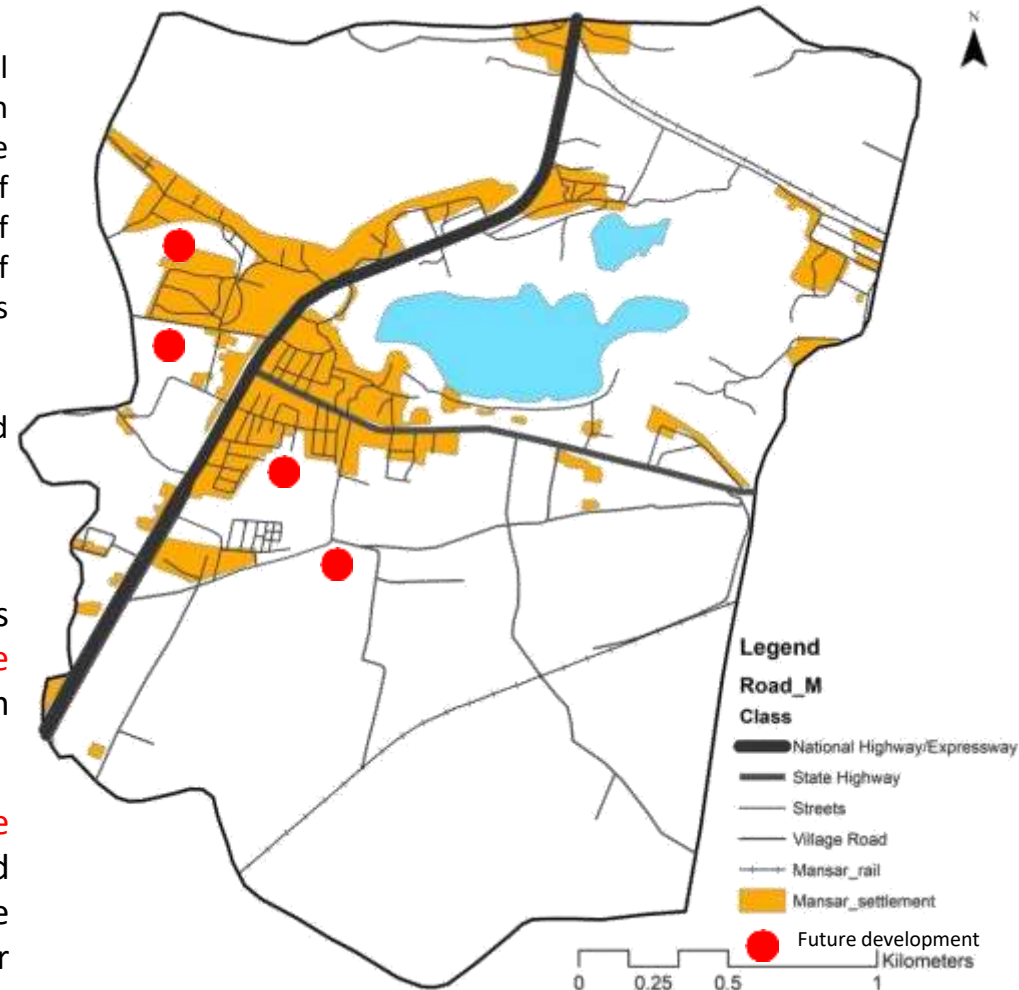
Tourism Proposals at Destination level

Mansar is significantly known as a halt point, located at the junction of NH7 & SH249.

NH7 leads toward Pench National Park: Tiger Reserve) & SH249 leads towards Ramtek: a religious place.

Tourist places at Mansar (as per the appearance order from Nagpur towards Ramtek)
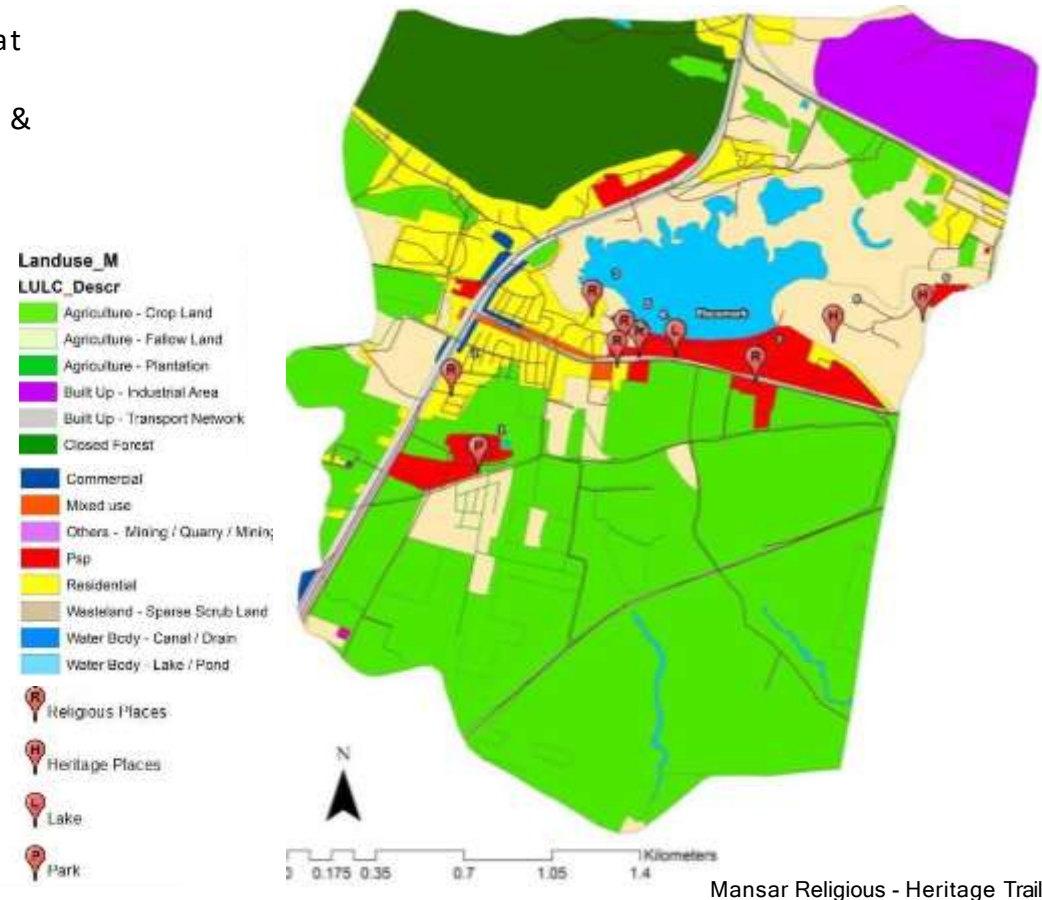
- **Park / Recreational Place**
1. Ramdham Cultural Park
- **Religious / Cultural places**
2. Jama Masjid
3. Shila Aai Temple
4. Krishna Temple 1 (Mahanbhav Pantha Devasthan)
5. Krishna Temple 2 (Mahanbhav Pantha Devasthan)
6. Hanuman Temple
7. Buddhist Temple (Bodhisatva Nagarjuna Santha Temple) & Museum
- **Heritage Structures**
8. Excavated Stupa over Hindimba hill
9. Excavated brick structure over Hindimba hill

Landuse_M
LULC_Descr
- Agriculture - Crop Land
- Agriculture - Fallow Land
- Agriculture - Plantation
- Built Up - Industrial Area
- Built Up - Transport Network
- Closed Forest
- Commercial
- Mixed use
- Others - Mining / Quarry / Mining
- Psp
- Residential
- Wasteland - Sparse Scrub Land
- Water Body - Canal / Drain
- Water Body - Lake / Pond

- R Religious Places
- H Heritage Places
- Lake
- P Park

Mansar Religious - Heritage Trail

PROPOSALS

- Bus stops near Park along NH7 & near Religious places along SH249 supported by IPT infrastructure for last mile connectivity.
- Amenities like eateries, drinking water kiosk, public toilet, solid waste disposal facilities and locker rooms etc at all the destinations.

P R O P O S A L

Tourism Proposals: Trail and Circuits

Tourism Trail

The **trail** or route provides a themed and interpreted journey through the urban or rural landscape, creating links between sites, attractions, and other tourism businesses.

Start Point: Ramdham Park (well known Spot)
End Point: Excavated brick structure & Stupa over Hindimba hill
Trail length = 3.25 Km & **Total trail time**= **5.65 Hrs**

Tourism Circuits

A Tourist circuit is **a route on which at least three major tourist destinations are located** such that **none of these are in the same town, village, or city**".

Nagpur-Mansar-Ramtek-Nagpur Religious circuit
Start & End Point: Nagpur City via NH 7 & SH249
Destination Point: Ramtek
Circuit length = 55 Km (One way), 110 Km (Round trip)
Total Circuit time = 10.48 Hrs approx. 11 Hrs

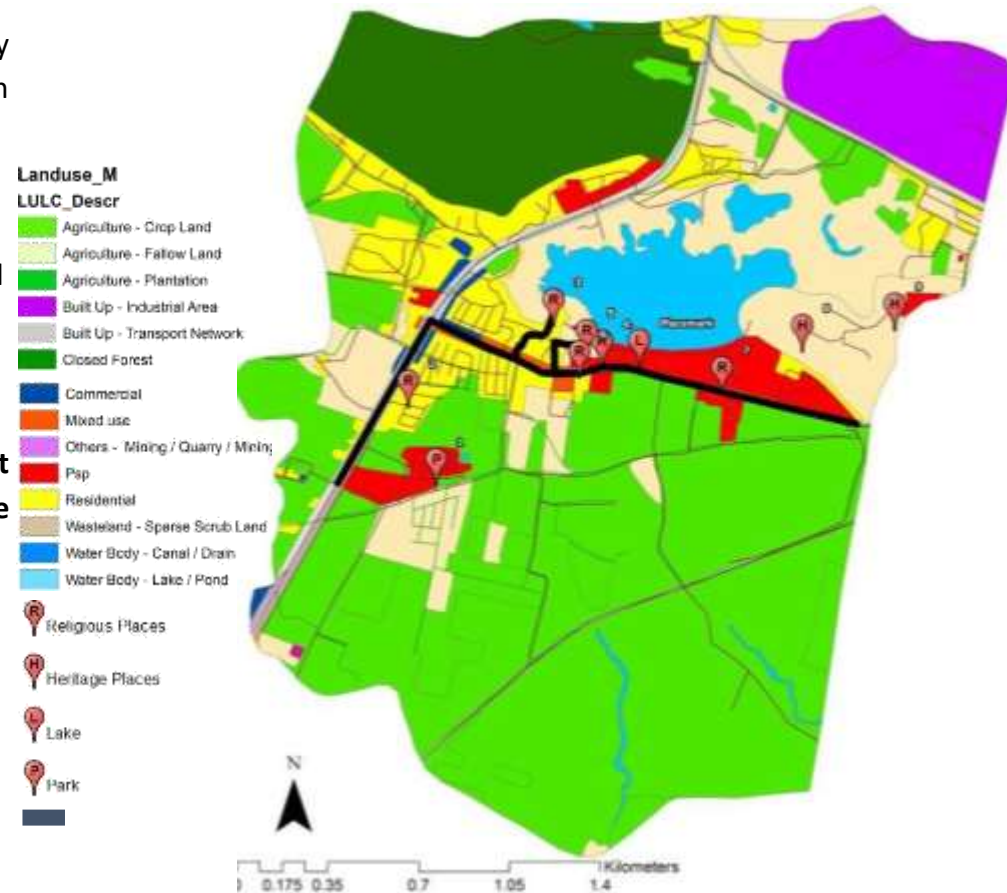Nagpur-Mansar-Pench-Nagpur Natural Heritage circuit
Start & End Point: Nagpur City via NH 7
Destination Point: Pench National Park
Circuit length = 70 Km (One way), 140 Km (Round trip)
Total Circuit time= 7.33 Hrs approx. 7.5 Hrs

Landuse_M
LULC_Descr
- Agriculture - Crop Land
- Agriculture - Fallow Land
- Agriculture - Plantation
- Built Up - Industrial Area
- Built Up - Transport Network
- Closed Forest
- Commercial
- Mixed use
- Others - Mining / Quarry / Mining
- Psp
- Residential
- Wasteland - Sparse Scrub Land
- Water Body - Canal / Drain
- Water Body - Lake / Pond
- Religious Places
- Heritage Places
- Lake
- Park

0 0.175 0.35   0.7   1.05   1.4   1 Kilometers

Map showing Mansar Religious - Heritage Trail

*"The village is the cell
of the national body and the cell-life
must be healthy and developed
for the national body
to be healthy and developed"*

- Shri Aurobindo

T H A N K   Y O U

RURAL VULNERABILITY DRIVERS (Vulnerability Related to various Factors)

Social
- Food Insecurity
- Poverty/Hunger/ Scarcity
- Inequity
- Discrimination by gender
- Limited access to information, Knowledge and Health care Facilities
- Social Exclusion

Infrastructure / Physical
- Population Density
- Remoteness of Settlements
- Materials used for critical infrastructure
- Site/ Building design on unsafe conditions
- Unregulated landuse planning

Economical
- Low economic status of individual/ system
- Lack of Resources
- Limited land ownership
- Insufficient Livelihood opportunities
- Lack of insurance for informal workers
- Dependence on single industry

Governance
- Weak local Institutions
- Insufficient Local Labour Market institutions/ skill development
- External/ Internal Conflicts
- Insecurity/ Poor condition of Regulations

Environmental
- Resource Depletion/ Degradation
- Overconsumption of natural resources
- Climate Change/ Biodiversity
- Deforestation
- Natural Hazards
- Ecosystem Services