

Towards nature-based spatially integrated planning in rural areas

A status review to bridge the gaps for the way forward

Understanding Rural Settlement Growth Patterns

A pilot study in the Tarava Gram Panchayat, Gumma Block, Gajapati District, Odisha

Preliminary Study Report

based on

Rapid appraisal visits to Tarava Panchayat

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Table of Contents

ABSTRACT.....	2
1. Rationale and Background to the study.....	3
2. Research Questions.....	3
3. Geographical focus.....	4
4. Literature Scan (partially included).....	4
5. Methodology & Data Sources.....	5
A. Secondary data on Development Planning.....	6
B. Trend Analysis: sorting out the discrepancy in databases.....	6
C. SURVEY:.....	10
D. Problem Analysis.....	11
6. Preliminary study lessons and hypothesis formation.....	11
Summarizing.. ..	13
GDP in Tarava Panchayat.....	14
7. Next step to validate hypothesis.....	15
Tarava Panchayat Overview.....	15
Tarava and Buruding identified as growth centres.....	18
Tarava Village.....	19
Bibliography (in Progress).....	22
APPENDIX.....	23
APPENDIX 1: List of households selected for survey during village discussions.....	23
APPENDIX 2: Letter to ORSAC requesting shape files.....	24

ABSTRACT

This report is a collation of information from different sources with the aim of identifying the most reliable and suitable database for the current study. The data-sources and results from each source are elaborated in the Methodology section of this report.

Another aim of this report is to identify gaps in the information collected so far and decide on parameters that need to be included in the household survey to be carried out in the final phase of this study (see text in red in the report). It is with this in mind that the study hypothesis has been (re) formulated in Section 6 and 7 of this report as a suggestion and for validation before proceeding with the household survey.

One output of this study is likely to be a spatially informed visualization of the current status of the Tarava Panchayat that can be used for discussions with the community to elicit nature-based and SDG-aligned resilient infrastructure for basic needs like water, energy, livelihoods and other development options. The current study offers tools for conducting such an informed discussion with the community at the habitation level, consolidated to the Gram Panchayat level, as an initial step towards nature-based spatially integrated collaborative and community-based planning exercises in future.

1. Rationale and Background to the study

There is increasing investment in rural infrastructure and housing as well as in digital tools for governance at the gram panchayat level. While the tools are meant for tracking progress of work, and information is available at the Block, Panchayat and Zilla level there may be miles to go before the information is accessed by the common person in the villages leave alone leveraged for their benefit. And miles to go before the goal of and for transparency is achieved. There is opportunity however, for development practitioners to access these tools and engage in planning for sustainable growth by understanding existing land uses (residential, agriculture, recreation, community, and commercial activities, among others) and reviewing their ability to enhance local livelihood opportunities. Overlays of existing resources such as water, forests, wetlands, land (for livelihoods, common land, wasteland, land for settlements), along with village assets and infrastructure and mapping of disaster-prone areas could help in planning for sustainable and resilient livelihoods and minimize ecological damage in the short and long term. Integrating existing rural development planning programs with digitized land use maps and providing tools for visualization, could improve decision making processes and make them more transparent, and therefore improve participation of the community.

The proposed study is an attempt to document the patterns of growth and their drivers in rural settlements along with the planning mechanisms and tools in place. The aim is to explore the potential for spatially integrated rural planning processes, their demystification, leading to better decision-making through visualization and enhanced participation. Hence the title, *“Towards nature-based spatially integrated planning in rural areas. A status review to bridge the gaps for the way forward.”* The purpose of the study is further elaborated as:

1. To engage with stakeholders in planning for sustainable growth
 - a. by understanding existing land uses (residential, agriculture, recreation, community, and commercial activities, among others) and
 - b. reviewing the ability of current land-uses to sustainably harvest and replenish renewable resources
 - c. maintaining fidelity/viability of the habitat prioritising land-use appropriately during future village/town planning
2. To integrate development programs into the rural community-based micro-planning scenario,
 - a. by providing tools for visualization that could improve decision making, (DM) processes and
 - b. make DM transparent and improve community participation.
3. To synergize with Gram Vikas', (GVs) Water Secure Gram Panchayat Program
 - a. by examining if there is effective management of water resources at the habitation level and
 - b. by strengthening the local governance to facilitate sustainable water management.
 - i. *Water resources are one among several other layers considered while studying the rural planning and development scenarios and GV is already quantifying them.*

The overall objective of this study is therefore to examine the settlement growth patterns and efficacy of the current mechanism for planning at the panchayat level and suggest an integrated approach for spatial development planning in line with the resource base.

2. Research Questions

1. Are there significant changes to the land use patterns of villages of growing panchayats¹ :
 - Are the rural housing program and the development programs in the village being planned keeping in view future growth patterns and existing land use?
 - Is the land use change forcing a change in people's consumption patterns or are consumption patterns linked to changing aspirations driving land use change.
2. Are current land uses appropriate for promoting a sustainable growth pattern for the future, or do we need to review and re-allocate them as needed?
 - Can we build in sustainable access to water and energy and disaster resilient housing and infrastructure (roads, drains, public buildings) all in tune with the carrying capacity of the existing land?

¹ Earlier question formulation: Is changing land-use resulting in a change in consumption patterns leading to need for imports in the economy, or are changing aspirations resulting in imports leading to changes in land-uses

- Can waste management systems (especially for grey water re-use and liquid waste) be integrated into planning norms to offset likely pressure on water resources (and avoid contamination of water sources).

3. Geographical focus

The pilot study is in Tarava Gram Panchayat in Gumma Block of Gajapati district, which is one among the 27 Water Secure Gram Panchayats (WSGP) identified by Gram Vikas. Tarava is one among the 19 Gram Panchayats of Gumma (and 149 of Gajapati) and an operational Tribal Sub-Plan block with the predominance of the Scheduled Tribe, Sauras. Tarava block falls under the jurisdiction of ITDP.

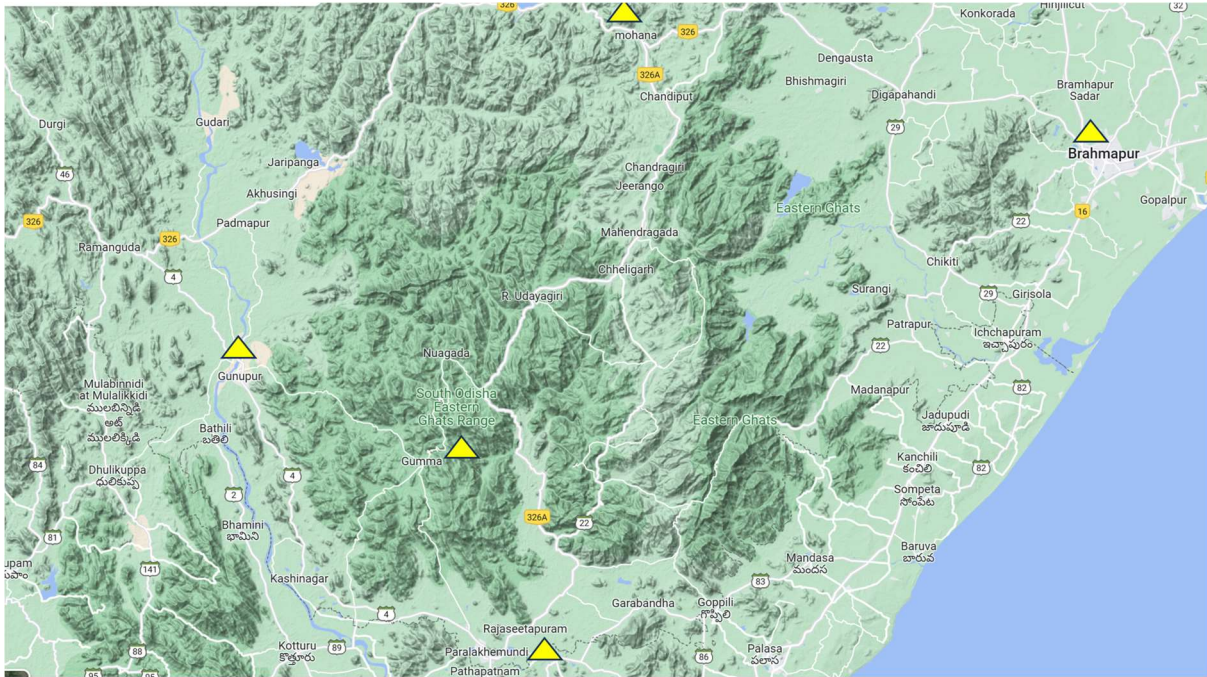


Figure 1: Map showing location of Gumma, Tarava's Block HQ, and the connectivity to other major towns in the district

The map in Figure 1 above shows Gumma, the Block headquarter of Tarava, and its connectivity with Gunupur, Paralkhemundi as well as to Mohana and Brahmapur. Gumma is the main market for Tarava, where a weekly haat continues to be held. All villages are within 4-5 kms from Gumma. The Panchayat office is in Tarava, which is also within 3-5 kms from all the 9 villages belonging to Tarava GP. Information on the GPDP was collected from the Block office and revenue maps from the RI office. Paralkhemundi is the district head quarter (Zilla Parishad office) and the rural housing planning for all the blocks takes place here. All programs at the block level (housing as well as the GPDP etc.) are integrated at the Zilla Parishad by the Planning and Convergence Department.

4. Literature Scan (partially included)

A review of literature was done to (a) understand existing studies on the India rural settlement/economy growth patterns (b) develop a methodology for data collection and identify relevant data sources: spatial and non-spatial at the GP level (c) identify applicability of GIS tools and remote sensed maps for a spatially integrated decision-making system. Information relevant to the current study are included below.

Geospatial tools for several urban mapping and planning have been undertaken in various studies using open source platforms and developing easy to use interfaces to facilitate greater user participation. One such tool, GeoSlum or GeoMap was developed to enable users at different scales, both individuals in slums to update information and develop community maps as well as government authorities to plan, execute and monitor activity. The rationale for developing these tools emerged from chaotic development due to the the lack of comprehensive planning approaches, absence of plan-finance linkages and decision-making tools and platforms and also missing institutional capacity. All this is also valid for rural development also and this is being recognised in government circles also. The need for spatially integrated Gram Panchayat Development Plans as a planning and monitoring tool for the government is being recognised but their value is amplified if used as mechanism to ensure informed participation of the community in decision-making by using it for micro-planning and subsequent monitoring.

Study by National Institute of Rural Development and Panchayati Raj, (NIRDPR), in Burgula Panchayat of Mahabubnagar district of Telengana state, was carried out with the purpose of including spatial mapping into the existing GPDP planning process. The study makes a case for spatial planning as a means to achieve development in tune with the resources in the rural area and makes for GIS as a tool since it integrates both spatial and non-spatial data (visual maps and census surveys can both be available). The study points out the lack of integration of spatial planning with development plans and opportunity to bridge this gap in the Rural Area Development and Plan Formulation and Implementation Guidelines (RADPFI 2016) updated in 2021. A spatially integrated GPDP is also proposed by the authors of the study, including both physical and non physical parameters (settlement/abadi, landuse as well demographics etc) which could result in a zoning system for rural settlements. The study create a dashboard that helped in mapping areas where development is happening in the gram Panchayat and highlights how that the marginalized section in the cluster are being left out.

MAPPING OF NIRDPR ADOPTED VILLAGE BURGULA FOR CATALYSING THE PROCESS OF DEVELOPMENT; Roy et.al.
Technical Specifications This research proposed a web-based interface as an efficient visualisation method to graphically display the data collected from Burgula Cluster. The research team used advanced open-source technologies to create a Web GIS application using Geoserver, Leaflet and PostgreSQL software. The data published in Geoserver was in the form of Web Map Services and Web Feature Services (WFS). The Leaflet API is used for creating a cost-effective Web-GIS application and is an open source JavaScript for displaying map services data in a web interface. Post-GIS is an extension of PostgreSQL, which is used to store spatial data in the database. The research team used QGIS Software for the preparation of geo-database. This application developed by the research team illustrates basic web functionalities like measuring area, distance, toggle layer selection, pan, zoom, home, legend button, etc. Moreover, a dashboard has been made to visualise socio-economic data of households collected through Open Data Kit (ODK) forms and geo-tagged entities. This dashboard includes further functionalities like word cloud, toggle-based map, layer control panel, marker cluster, drop-down selection, disable and enable charts, etc.

Studies point out the existence of several databases like the IMIS that currently map the water resources, their quality, quantity and delivery of government programs. They point out the discrepancy in the aggregated data available in these databases and the actual information at the habitation level. Wescoat et.al., have suggested strategies to overcome such disconnects, and some points relevant to this study are : (1) updating IMIS and census data and aligning them with GIS time series mapping (available from NRSA) (2) Consciously collecting information at the habitation level aggregated to Revenue village and GP level (3) Integrating IMIS, Census data with GIS mapping softwares being developed (4) Linking drinking water data with watershed/springshed aquifer maps to enable designing settlement-based sustainable watersupply systems that fulfil the stipulated requirement while ensuring adequate recharge measures. This would also enable correctly locating built spaces and infrastructure like roads, power-lines with minimum distruption to the resource base.

The Swamitva scheme of the Government of India for mapping land records through drones is a step in digitization of land records. A collaboration between the Ministry of Panchayati Raj, State Revenue department and The Survey of India, the Swamitva Scheme is an integrated property demarcation scheme to demarcate the inhabited land in villages (abadi land). Images are captured using Drone technology and Continously Opearting Resource Station (CORS) technology. The CORS for Gajapati district in Odisha is likely to be set up in Chandragiri in Mohana Block and Khajuripad in Nuagad Block.² This will lead to digitization of land records that are accurate and is likely to assist in the preparation of better GPDP plans. The scheme will make land records available to the homeowner and therefore the right to property, which is likely to open out avenues for applying for loans. However, how this will be applicable to those residing in Tribal Sub-plan blocks is not clear, as land in these areas cannot be mortgaged/sold.

5. Methodology & Data Sources

The current preliminary study was undertaken as a pilot in one Gram Panchayat, Tarava in Gajapati district. Some inferences have been drawn, and used to fine tune the methodology and identify next steps. There are several data sources that were used to traingulate information and in the process also checked for reliability:

- a. Several platforms are available: Panchayati Raj ministry: Gram Manchitra; , India Water Resources Information Centre, ORSAC's Odisha's Geospatial portal for urban and rural planning (Odisha4kgeo),

² Pers.Comm; Sub-collector, Gajapati, June 2023.

Bhunaksha, Bhuvan nrsc ISRO’s geospatial website, Census of India Portal (2002, 2011). The last three have been used and cross-checked for consistency.

- b. Gram Vikas household survey, conducted in 2021
- c. Focus Group Discussions and Key Informant Interviews with resource persons in the village; Officials in the Zilla Parishad office (Parlakhemundi); Block Office (Gumma), Tahsildar’s office (Gumma).

Four major steps were envisaged in the methodology:

- (1) Secondary data on development planning
- (2) Land use pattern trend analysis, wherever information was available
- (3) Surveys to bridge the data gaps
- (4) Problem Analysis.

These are discussed below mainly summarizing some preliminary inferences, shortlisting parameters for a selective household survey and clarifying the possible next step of problem analysis/Solution-Search. The aim is to keep in focus that this is a community-based action research that aims to collaboratively find nature-based solutions that can be translated into action on the ground.

A. Secondary data on Development Planning

Secondary data available on Tarava GP :revenue/cadastral maps and GDP plans and outlays were studied to understand the focus of the GP, see if there is an integrated approach to the planning process, and if the convergences envisaged are actually taking place in-practice.

As an output, land use from downloaded maps can be overlaid with assets proposed in development program and compared with what is actually created and happening on the ground.

B. Trend Analysis: sorting out the discrepancy in databases

Land use pattern over a time-period are likely to show a trend: whether the growth is a planned process or are things happening ad-hoc/choatic way, disturbing the natural resoruce base (esp the hydorology and land-use patterns). Trends from secondary data will be validated through household/village surveys.

Some preliminary inferences on trends as indicated from different data sources is included below to highlight mainly the discrepancy in data and to identify the most relevant one for our work.

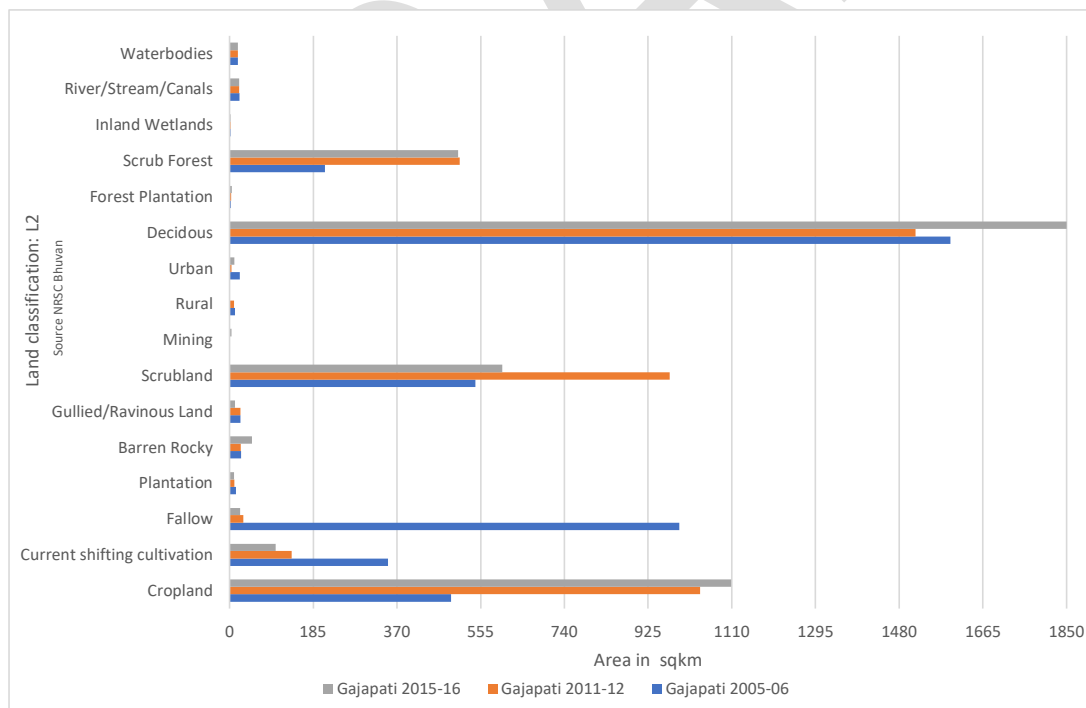


Figure 2: Land use of Gajapati district over three time periods as per NRSC data

Based on the NRSC Bhuvan database, Gajapati district apparently recorded a growth in forested area, a reduction in scrubland and fallows and an increase in agriculture (Cropland) over the period 2005 to 2015. The water sources during this ten year span have more or less been stable, neither growing nor reducing.

According to the WRIS database from the National Water Informatics Centre, the total area for Gajapati district is smaller in comparison to the NRSC Bhuvan data (which comes with spatial maps) which in turn is 5% lesser than the Geographical area as per Census information. The land use classifications are also different in each of the sources.

NRSC data shows Gajapati is predominantly (Table 1) a forested district with over 54% forested area, 29% agriculture (including cropland and plantations), 15% barren land (designated as wasteland), 1% water sources and less than 1% built up area.

The census data shows only 16% forest (740/4533sqkm) and 36% as barren/unculturable wasteland (1626/4533 sqkm), net sown area (cropland) is 29% and non-agri uses is 11%.

Table 1: Land use land cover of Gajapati district: comparing NRSC, Water Informatics Centre and Census Data

District and category wise distribution of land use /landcover in Gajapati in Sq.kms (100ha= 1 sqkm)							
L1	L2	Gajapati 2005-06	Gajapati 2011-12	Gajapati 2015-16		2017-18	2009 (ref yr.) Chk w/2011
Agriculture	Cropland	489.62	1039.76	1108.41	25.6%	837.13	1226
	Current shifting cultivation	349.75	137.67	101.96	2.4%	0.00	^143
	Fallow	993.86	29.96	23.16	0.5%	39.33	#149
	Plantation	14.58	10.85	10.17	0.2%	9.77	162
Barren/ Unculturable / Wastelands	Barren Rocky	25.28	24.73	49.16	1.1%	624.77	Barren + culturable wasteland
	Gullied/Ravinous Land	23.82	23.83	11.84	0.3%		
	Scrubland	542.84	972.43	602.3	13.9%		
Built Up	Mining	0.06	0.23	4.68	0.1%	13.39	Non-Agriculture uses
	Rural	12.16	10.38	0.23	0.0%		
	Urban	23.04	4.45	10.66	0.2%		
Forest	Deciduous	1593.49	1516.02	1849.99	42.8%	1957.91	740
	Forest Plantation	2.81	3.75	5.07	0.1%	* 286.6	
	Scrub Forest	211.04	508.76	505.64	11.7%	129.13	
Wet lands/ Water bodies	Inland Wetlands	2.24	2.17	2.17	0.1%		
	River/Stream/Canals	21.63	21.15	20.98	0.5%	7.30	
	Waterbodies	18.77	18.85	18.57	0.4%	22.96	
Total	TOTAL Sqkm	4324.99	4324.99	4324.99		3928.29	4533
		Round off	4325 Sqkm	432499 ha		National Water Informatics Centre	Census data file

Source File name: Tarava_Village List (Tab: LULC-Districtwise); (2017-18 * classified as Evergreen forest (www.indiawris.gov.in); Census 2009 ref year (2011 census) #Current 94+other than current fallows 55; Total 149 sqkm; ^ Pasture land

For this study, it may be best to ignore the Water Informatics dataset and use remote sensed data where spatial information is available along with Census data. Spatial data from the ORSAC website is available at the Block, GP and village level. It will be useful to now look at block level information (Gumma) and the Gram Panchayat level information (Tarava) and compare with the Census data.

LULC Area in hectare	Gumma Block	Tarava GP	1. Ashryagada	2. Buruding	3. Guleijung	4. Jadda	5. Kharigumma	6. Linga	7. Patimul	8. Shamagainta	9. Tarava	10. Tamakumar
Area : as per LULC data, 2015-16 ORSAC geospatial portal Odisha4kgeo.in	53,000	1,704	84	273	149	106	28	96	76	238	627	26
Percentage of Tarava GP area			5%	16%	9%	6%	2%	6%	4%	14%	37%	2%
Area: From Census, reference year 2009 https://censusindia.gov.in/nada/index.php/catalog/932	1,05,478	3,419	185	581	320		60	205	167	508	1,334	59
Percentage of Tarava GP area			5%	17%	9%	0%	2%	6%	5%	15%	39%	2%

The total geographical area of information from the ORSAC website with the cadastral level mapping shows a wide variation from the Census database, although the percentage share of each of the villages is the same.

Census geographical area is defined as “the latest figures of geographical area of the State/Union Territories as provided by the Office of the Surveyor General of India,” and includes forest land,³ which is not included in the ORSAC information. ORSAC spatial LULC maps use information from the Revenue department and the Census database also claims to use digitized maps, so the discrepancy is not explainable. If we exclude the forested area from the Tarava GPs Census data, the total area becomes 2447 ha, which is still 30% more than the area reported in the LULC from the ORSAC geospatial database.

Conscious of this discrepancy, the LULC maps from ORSAC are used at this stage only to understand the distribution of different uses, and identifying information that needs to be checked through surveys. A request has been made to ORSAC for procurement of the following Shape files: (1) LULC maps for the year 2008-2009 and 2018-19 developed as a part of (SSIDP) Govt. of India Directorate of Space project and 2. LULC for the year 2015-16 developed for Odisha 4KGeo website. Analysing the land-use in these maps may offer some explanation.

Gumma is one of seven Blocks of Gajapati district, has 18 Gram Panchayats and 220 villages. The left hand side map is from the District Census handbook and the right hand side map from the ORSAC geospatial website, which gives the land use distribution (see table below) for 2015-16. The Reserve Forest demarcation shows four patches in the ORSAC maps, which correlates with 2 out of 3 of the Census map. The total geographical area of Tarava as per the Census (2011) is 3419 ha (~34 sqkm) while the ORSAC LULC pegs it at 1704 ha. Deducting the forest area from the census information, the geographical area of Tarava as per the Census 2011 is 2446 ha, a difference of 30% compared to the ORSAC LULC tabulation.

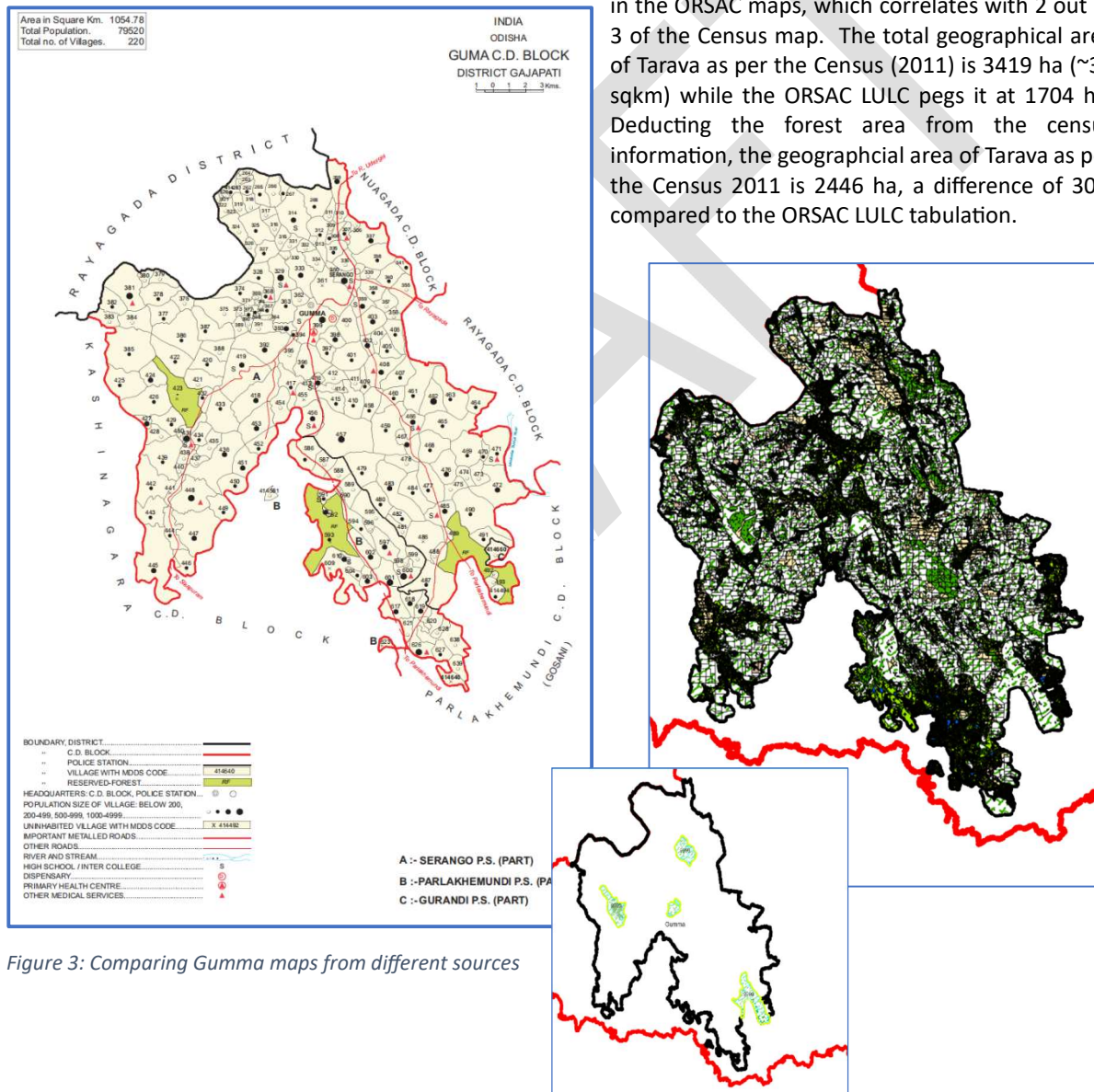


Figure 3: Comparing Gumma maps from different sources

³ Forest Area : This includes all land classified either as forest under any legal enactment, or administered as forest, whether State-owned or private, and whether wooded or maintained as potential forest land. The area of crops raised in the forest and grazing lands or areas open for grazing within the forests remain included under the “forest area” (Source: Census of India; Concepts and Definitions)

Table 2: LULC - level 1 Area for Gumma Block (in hectares) (100ha= 1 sqkm)

Category	LULC Area	Type Total (rndoff)	Percent
Agricultural Crop	12119.92	12120	23%
Vegetation / Forest Land (other than revenue : tree-cover)	33679.57	33679	63%
Surface Water Bodies	429.01		
Wetland	2.58	432	1%
Construction / Infrastructure Units	47.63	48	0%
Built- Up (Housing/ Utilities/ Services)	82.28		
Built-Up (Industrial)	0.05		
Built-Up (Rural)	359.91		
Built-Up (Transport)	543.06	985	2%
Mining Areas	0		
Vacant Land (Rural)	475.87		
Vacant Land (Urban)	14.72	491	1%
Wastelands / Underutilised Lands	5245.43	5245	10%
Total Area (Revenue)	53000.03	53000	

The cadastral map from the ORSAC website shows the reserve forest in dark green but this does not seem to be included in the LULC classification that includes plantation as well as agricultural crop under the class Green cover.⁴ The distribution of the overall land use percentages for the Block are more or less in line with the district landuse, with the cropped area being slightly less than the district total and the tree cover being slightly more probably because it includes plantations and scrub (percentages match not numbers).

Table 3: LULC Area, level 3 for Gumma Block (hectares) (To convert ha to sqkm divide by 100).

Category	LULC Area	Type Total	Percent
Agricultural Plantation	4.27	35644.94	67%
Horticultural Plantation	849.9		
Scrub Vegetation	1962.9		
Tree Clad Area	31623.92		
Others	1111.2		
Plantation	92.75		
Crop Land (Under Crop / Fallow)	10154.56	10154.56	19%
Commercial	2.04	985.29	2%
Communication	0.11		
Industrial Estate / Ssi / Others	0.05		
Public / Semipublic / Religious recreational	58.09		
Public Utilities / Services	14.14		
Recreational	1.33		
Residential	6.56		
Residential Rural	359.91		
Transport (Road)	543.06		
Infrastructure	22.17	47.63	0%
Quarry	25.46		
Man Made	108.64		
Natural Water Bodies	320.37	431.59	1%
Natural Wetlands	2.58		
Reclaimed Land / Landfill Area	14.72	490.59	1%
Landfill / Reserved Areas	475.87		
Mining Areas	0		
Culturable Wastelands	3994.83	5245.42	10%
Unculturable Wastelands (Non- Green Cover)	1250.59		
Sum Total	53000.02	53000.02	

The extent of reserve and revenue forest in Gumma will need to be ascertained separately through ground surveys, along with the dependence of the community on these for NTFP based livelihoods. The breakdown of the landuse land cover into level 3 categories (Table 3 above) shows the extent of plantations (probably mainly cashew and rubber in these areas) and also indicates that the contribution to built up is mainly from roads and rural housing. The designated landfill reserved area needs to be identified and the usage understood as this could be where the waste of the neighbouring city/town is dumped and will have implications on both ground/water and air pollution. These are some of the parameters to be checked in the survey at the village level.

⁴ For revenue purposes there are four (4) types of land classification: (1) Abadi Jogya Ananbadi (AJA); (2) Abadi Ajogya Ananbadi (ANA) (2) Rakhita (Reserved for forest and other green activities) (4) Sarvasadharan Jameen (Communal land).

C. SURVEY: Over and above the parameters outlined above the aim of the survey is to understand supply and demand factors, resources (what is available and where is it being used), consumption patterns (current food, fuel, income) other needs: education, health, consumer goods). In addition, the aim will be to (a) to identify the resources available for planning and the decision-making processes that are already in place (b) Focus of village development programs ? What are people’s needs and aspirations.

For demographic information which is dynamic, data from the Census 2010 will need to be updated as the last survey was conducted in 2009-10, more than 14 years. Gram Vikas’s baseline survey (2021) has several relevant parameters that could be used after verification. The population (and household) figures will need to be verified, especially when there is a dip in population of the village, and reasons identified for the same (Table 4).

Table 4: Village wise household and population: Census data and Gram Vikas’ survey

	2021	2011	2001	2001-11	2021	2011	2001
Habitation Name (/Census database)	GV database : Source: Tarava database.xlsx	No_HH https://censusindia.gov.in/censuswebsite/data/census-tables	No_hh https://censusindia.gov.in/censuswebsite/data/census-tables	Decadal change in population	GV database: Source: Tarava database.xlsx	TOT_P https://censusindia.gov.in/censuswebsite/data/census-tables	TOT_P https://censusindia.gov.in/censuswebsite/data/census-tables
Regedi (Tarava TIA)		83				351	
Roising (Tarava TIA)		40				219	
Buruding	89	91	61	51%	445	433	286
Tamkumar	12	14	18	-14%	30	62	72
Patimul (Patimul colony)	111	80	63	5%	438	352	336
Linga	91	81	62	30%	432	345	265
Gulaijang	41	34	28	14%	278	139	122
Tarava (TIA+Taraba+Taraba colony)	226	191	144	37%	730	961	700
Ashrayagada		185	167	21%		962	792
Khariguda	74	46	21	112%	334	220	104
Samagaintha	58	48	40	5%	190	181	173
Total		770	604	28%		3655	3014
Total w/o Ashrayagada*	702	585	437		2783*	2693	2058

Tarava_Village List.xls Tab: 2011-2001 (2)

Gajapati’s decadal population growth rate from 2001 to 2011 is 11.37 % (District Gazetteer), which is lower than the State growth rate of 14.05 % (in the 2001 census Gajapati recorded an increase of 14.10% compared to 1990). In the District Gazetteer Serango (sub-district where Gumma Block is located) recorded an increase in population of 18.92 % for the period 2001-2011. Data collated for Tarava GP shows a much higher population growth rate of 28% with some of its villages like Khariguda growing much more than others. The likely explanation for the growth in Khariguda is that is close to Gumma, an employment centre with a high migrant population looking for rental accommdation that the village provides.

If we use the Gram Vikas’ survey to understand the population growth between 2011 (2009 reference years) and 2021 it is only about 3% (from 2693 to 2783). Linga, Patimul, Buruding and Khariguda contribute to the growth while Tamakumar and Tarava (Taraba) show a decline. While Tamakumar, a hillside village has had people moving/migrating to Linga and Patimul and other villages in the plains, the reason for the dip in Tarava’s population is not clear. Migration could be one of the reasons, but the other reason could be that there are people from other villages being settled in Tarava through ITDA land allotment.⁵ Whether these settlers are being included in the population count has to be checked. Analysing the information on four land types as received from the RI office, government land in Tarava is 27% of the Census geographical area and 57% as per ORSAC geog area.

Dependency ratio, migration and agriculture land ha/person in these villages could also be assessed over a time period to understand the village growth. The household survey will include these parameters, viz. population, households, agricultural land, earning members and sources of livelihood, besides understanding dependence on migration of each household. The trend in housing and cooking fuel will also be mapped along with livelihood patterns, and could be used to compute the per capita energy consumption as a metric for mapping growth trends. A list of 15-20 households have been identified through informal discussions at the village level in Tarava, Samagaitha, Buruding from whom information will be collected (See Appendix). Names of people in Patimul, Patimul colony and Linga have also been noted and may be included if needed.

⁵ Perscomm. Gopan; April 2023

D. Problem Analysis

The table below identifies the scope of work and parameters to be studied as defined in the three data collection methodologies outlined above.

As an initial step, information on development programs and trend analysis has been initiated and preliminary information collected that has helped to identify parameters for the household survey.

Table 5 below has been updated and activities prioritised based on the initial phase of data collection. Adapting Doxiadius principle of optimization of the quality of humans relationship with their environment, which according to him consists of “nature, society, shells (buildings and houses of all sorts and networks (ranging from roads to telecommunication), the role of the State has been added.

Based on the preliminary assessment, priority is given to Nature, Shells and Networks. The third parameter, (hu)Man will be based on existing surveys, verifying existing data as needed. The fourth and fifth parameters, Society and State will be taken up in the end, through discussions and exchanges in a workshop format with the community.

Table 5: Broad framework for analysis

	1. Survey: Primary Assisted by Secondary data from census, focussed survey is intended to map changes over time	2. Trend Analysis: Map layers - Source: Google Earth, Topo sheets, revenue maps	3. Development programs – GPDP, ITDA: Govt. & NGO driven	Problem Analysis: Intersection of 1, 2 and 3 to assess growth (possible parameters to be studied..)
Nature (natural resources: forests, land-use including water resources)	Land ownership, cropping pattern; water resources (qty, qly, use-from GV survey) catchment land class, forests - green cover: individual, community, Revenue, Reserve) Resource use patterns	Land use change: Doxiadius Principle of maximization of contact with nature	Forest (FRI, CFR), Revenue forests and Social Forestry, Amrit Sarovar, Asset Register	Changes in usage patterns: Water and Energy-Carbon
Shells (buildings and houses of all sorts, built form and its growth)	House then-now, Kitchens, Community buildings (water tanks), commercial buildings (shops, mills, Aanganwadi, PHC, school), others (ENERGY use: cooking, embodied, operating...)	Growth: built form (density) , change in material use: Doxiadius prin. of optimization of humans protective space	PMAY-IAY-BPGY; PMGSY (road construction)	Energy (MJ) to Carbon (tC); Water usage (L); Waste generated (kg) Secondary Sector: Consumption (material, labour)
Networks (roads, telecommunication, other infrastructure services)	Roads (hierarchy), gray water, soak pits, water catchments, electricity, telecom (travel distances and needs: Doxiadius prin of minimization of effort)	Changes in road networks	PMGSY, Village Roads, State Highways, Interstate, Bridges, Mobile towers	Distances travelled for different activity/role of iternet
(hu)Man (socio-economic factors: demographics, livelihoods)	Households, Houses, Chulhas, Population (growth rate) , Age, Sex demographics, Diff Abled, Education levels; income and Occupation patterns: (Units: no., Rs) Migrants	Population growth	Aadhar, Ration, BPL, Job Cards and days of guaranteed job, Bank Passbook, Insurance: crop, medical, Agri related	Consumption patterns: local vs purchased in: Food; Fuel; Fodder Goods and Services Dependency ratio; land/hh
Society (community: cultural & institutional structures)	Church and role; NGOs, Banks, FPOs, SHGs (Role and influence of) FGD perhaps	Religious & development trends	Nutrition, Health, Farmer- agri-subsidies, Skills	
State (development programs)	Sarpanch, Ward Members, GRS, ASHA – Health centre, Balwadi didi, Schools, Aanganwadi (Investmeet pattern, Role and influence of)	Size of representation in governance;	GPDP, DRDA, RI, Forest, Gramin Bank, ITDA	

Information collected has been discussed under the methodology section in this version of the report as a way to determine the most reliable datasets to be used for the study. Once decided, this information will be validated and analysed and presented as a part of the Problem Analysis in subsequent versions of the study report.

6. Preliminary study lessons and hypothesis formation

Gram Vikas is working on “Water Secure Panchayats” and Tarava Panchayat is one among the 27 where work is ongoing. Tarava Panchayat consists of 10 revenue villages and 20 habitations.

All data collected by the government gets aggregated to the GP level, the smallest scale of the local government where planning takes place. The data for census surveys is collected at the level of the Revenue village and data for monitoring infrastructure including housing, water and sanitation is done at the scale of the habitation. Watershed boundaries add another layer to this already complex level for analysis and triangulation of information. Monitoring of information requires to be done at the disaggregated level and accessing multiple sources for triangulation has highlighted errors. **Discrepancies are observed with respect to the total geographical area from the Land use land cover tables, when compared with the Census data (for 2011).**

Shape files, which are the basis for mapping spatial data are available at the revenue village level only. There is now a move to digitise cadastral level maps and in Odisha, ORSAC has uploaded maps for 2015-16 on their geospatial portal, but these maps are not downloadable. ORSAC provides ready-maps for study purposes to Universities free of costs (otherwise available at a cost/sqkm). LULC maps for the period 2008-2009 and 2018-19 developed under a SSIDP project and for 2015-16 (Scale 1: 10,000) and for their 4K Geo website (Scale 1: 4000). A request for these maps for Tarava GP has been put forward through Sri Sri University and electronic version of these maps are likely to be available.

Table 6: Classification basis of habitations/villages of Tarava Gram Panchayat

Gram Vikas VDC	Revenue Village	Habitation
1. Ashragada in-progress	1. Ashryagada	1. Ashryagada
2. Buruding	2. Buruding	2. Buruding
		3. Kumbiba
3. Guleijung	3. Guleijung	4. Guleijung
4. Khariguda	4. Khariguda	5. Khariguda
	5. Jadda	6. Uparkhariguda
5. Linga	6. Linga	7. Jedasing
		8. Abaring
		9. Linga
6. Patimul	7. Patimul	10. Padarsahi/Patara
7. Patimul Colony		11. Patimul
8. Tamakumar	8. Tamkumar	12. Patimul Colony
9. Tarava		9. Samagaitha
	10. Taraba	14. Upartamakumara
		15. Samagaitha
		16. Indraabsacolony
		17. Regidising
		18. Taraba
		19. Tarabacolony
		20. Ragaising

Tarava_Village List.xls Tab: 2011-2001 (2) Tab: Habitations - Tarava GP

Gram Vikas collects water resources data (source and utilization) at the habitation level and has for its own convenience clustered villages and formed nine (9) VDCs which are based on the community's convenience and not based on revenue villages (Table 6).

Currently water sources occupy 1% of the total land use, however, the catchment of the aquifer may occupy a much larger area and it will be useful to map these along with the sources so that one can understand how to keep these sources protected. Agriculture and Plantations occupy 89% of the land area and so it may be really important to understand change in cropping patterns, advent of plantation crops like rubber and cashew and the impact on the land use. Built forms still form a very small part of the total land use, and may not play a significant role in this GP, although in villages like Patimul, unlike Tarava, there is scarcity of land for the growing population and is being purchased from the neighboring village (Kalakote) which does not fall in the Tarava GP. Therefore expansion in one GP may be affecting the neighbouring GP.

As already mentioned the government land falls under four main categories: For revenue purposes there are four (4) types of land classification: (1) Abadi Jogya Ananbadi (AJA); (2) Abadi Ajogya Ananbadi (ANA) (2) Rakhita (Reserved for forest and other green activities) (4) Sarvasadharan Jameen (Communal land). Data for Tarava GP was collected from the RI office in Tarava through the Sub-collectors office. The data obtained shows only the Government land in the Tarava GP, which is 24% of the total geographical area (if we take the census data and 48% if we consider the LULC data from ORSAC!). *Raita* land or private land data may not have been included here and this has to be verified. **One exercise of seeing the distribution of land use of the government land will also be very useful to understand likely growth scenarios.**

This report is a preliminary attempt to address the two questions that we started with and to see if we were able to gain a better understanding on the way forward for this Action Research.

Summarizing..

Question 1: Are there significant changes to the land use patterns of villages of growing panchayats :

- Are the rural housing program and the development programs in the village being planned keeping in view future growth patterns and existing land use?
- Is the land use change forcing a change in people's consumption patterns or are consumption patterns linked to changing aspirations driving land use change.

Question 2: Are current land uses appropriate for promoting a sustainable growth pattern for the future, or do we need to review and re-allocate them as needed?

- Can we build in sustainable access to water and energy and disaster resilient housing and infrastructure (roads, drains, public buildings) all in tune with the carrying capacity of the existing land?

If we go by the district trends it appears that there is an increase in tree cover that could also be due to plantation cash crops like rubber and cashew, which has displaced shifting cultivation. There is also an increase in agriculture land, with dryland crops being replaced with paddy, mainly a rain-fed crop. There has been some efforts in the GP to develop canals for irrigation (see Linga timeline), although there appears to be more focus on ponds, creation of new water-harvesting structures (as per GPDP 23-24, in at least seven of the villages, with several in Tarava). The move away from shifting cultivation has also resulted in predominance of paddy in the diet in place of millets (see village timeline). The horticulture department has also played a role in the promotion of cashew in the area, while the Rubber Board has promoted rubber plantation, mainly through the ITDA. It will be useful to have a discussion with the ITDA department employees to understand their vision for the Panchayat. The Rubber Producer Association is currently setting up a rubber processing centre in Tarava, although there will be no further local value addition. From the available land use maps it is not clear which land has been used for the new plantations, although it can be inferred that the reduction in scrubland must contribute to the increase in Deciduous Forest classification (Table 1) and increase in cropland is due to the decrease in fallows.

Based on information from the Revenue office at Tarava it appears AAA and R, both unsuitable for settlements (abadi) contribute to over 90% of the government land, and there is very little change/mutation of these land uses, with some minor reduction in R: 0.924 ha converted for housing in four villages where FRA pattas were given (Taraba, Linga, Buruding and Samagaintha: Table 7). **Further clarification is awaited from the Zilla Parishad office in Paralakhemundi.**

Table 7: Land use information of Tarava GP from RI Tarava (excerpt of table)

SI No.	Name of the village	Total Govt. Land after Settlement as on 01.01.2023 in ha (hectares)					Total house site Area settled under OPLE and conversion (OLR-8A)		Remarks
		AJA	AAA	Sarvasa dharana	Rakhita	Total Govt land available as on 01.01.2023	as on 01.01.2011	as on 01.01.2023	
1	Tamakumar	0.000	4.775	0.222	11.375	16.372	0	0	09 Nos of FRA Title issued
2	Taraba	30.190	10.804	7.665	307.445	356.104	0.182	0.367	
3	Khariguda	1.928	2.890	0.185	4.827	9.830			
4	Linga	1.539	8.840	1.147	8.228	19.754		0.07	12 Nos of FRA Title issued
5	Guleijang	4.765	53.323	1.112	24.347	83.547			
6	Buruding	5.663	99.241	1.481	20.831	127.216		0.268	
7	Ashrayagada	10.578	11.294	1.365	9.199	32.436			
8	Patimul	0.130	26.751	1.053	5.275	33.209			
9	Samagaintha	2.309	89.975	1.036	47.815	141.135		0.037	
Grand Total		57.102	307.893	15.266	439.342	819.603	0.182	0.742	
		7%	38%	2%	54%	100%			

1) Abadi Jogy Ananbadi (AJA): land where settlements are possible; (2) Abadi Ajogy Ananbadi (ANA); (2) Rakhita (Reserved for forest and other green activities); (4) Sarvasadharan Jameen (Communal land).

Information from the Gram Vikas survey of water sources will be useful to understand the location of the catchment areas within current landuses and also to understand the capacity of the water sources vis-à-vis the demand. Currently only irrigation and household water supply is being measured. Industrial uses (Rubber processing centre for example) will need to be integrated. It will also be useful to understand the waste water generated along with their disposal.

As per GPDP 23-24, there is investment being made within the Gumma block in Sindhisinghi (Gumma GP) and Samagaitha (Tarava GP) for solid and liquid waste collection and disposal in Gumma, Luyib, Sindhisingi and

Sarsang (Gumma GP: investment in Services of Collection & transportation of waste from household to treatment site). Location of the treatment site will need to be ascertained through the survey and the land use of the particular site and its vicinity also clarified.

GPDP in Tarava Panchayat

Table 8: GPDP allocation for Tarava Panchayat: 2022-23 (Source file: GPDP2023-24All GP-rev1)

Sectoral View: 2022-23: Tarava Panchayat			Percentage contribution	
S.No.	Sector	Sum Total Outlay (Rs.)		Excl Admin
1	Administrative & Technical Support	3,02,000	10%	
2	Drinking water	6,37,410	22%	24%
3	Education	1,00,000	3%	4%
4	Land improvement	2,00,000	7%	8%
5	Roads	10,53,724	36%	40%
6	Sanitation	6,37,410	22%	24%
	Total	29,30,544		

<https://gdpd.nic.in/#reports>

Table 9: GPDP allocation for Tarava Panchayat: 2023-24 (Source file: GPDP2023-24All GP-rev1)

Sectoral View: 2023-24: Tarava Panchayat			
S.No.	Sector	Sum Total Outlay (Rs.)	Percentage contribution
1	Drinking water	1,38,83,160	83%
2	Health	13,03,180	8%
3	Land improvement	3,00,000	2%
4	Maintenance of community system	2,16,044	1%
5	Non-conventional energy sources	1,00,000	1%
6	Poverty alleviation programme	5,500	0%
7	Roads	3,00,000	2%
8	Sanitation	4,62,060	3%
9	Water Conservation	1,00,000	1%
	Total	1,66,69,944	

Table 10: GPDP 2023-24 allocation, according to the source of finance (Source file: GPDP2023-24All GP-rev1)

	Scheme Name	Amt Allotted (Rs.)	Percentage
1	XV Finance Commission	6,16,080	4%
2	MG National Rural Employment Guarantee Act	1,42,21,060	85%
3	XV Finance Commission	9,24,120	6%
4	5TH STATE FINANCE COMMISSION	8,04,044	5%
5	Own Funds	1,04,640	1%
	Total	1,66,69,944	

<https://egramswaraj.gov.in/webservice/approvedActionPlanExternalReport/117474/2022-2023>

If we exclude MGNREGA investment for Drinking water (piped water supply, rain water harvesting structures among others), Water conservation (construction of pond), health, and to a lesser extent in land improvement, Sanitation, NonConv Energy, Roads and Community system, the investment in Tarava GP from the Finance Commissions is Rs. 24,48,884 (15% share), which is lesser than previous allocation in 2022-23 of Rs. 29,30,544.

Realigning the questions as hypothesis (suggestive only, for comments/feedback):

<p>Question 1: Are there significant changes to the land use patterns of villages of growing panchayats :</p> <ul style="list-style-type: none"> • Are the rural housing program and the development programs in the village being planned keeping in view future growth patterns and existing land use? • Is the land use change forcing a change in people's consumption patterns or are consumption patterns linked to changing aspirations driving land use change. <p>Question 2: Are current land uses appropriate for promoting a sustainable growth pattern for the future, or do we need to review and re-allocate them as needed?</p> <ul style="list-style-type: none"> • Can we build in sustainable access to water and energy and disaster resilient housing and infrastructure (roads, drains, public buildings) all in tune with the carrying capacity of the existing land?

➤ New livelihoods coupled to changing land-use patterns of developing GPs will affect consumption patterns and in turn the environment adversely.

➤ There is scope for collaborative, spatially integrated, nature-based solutions aligned to SDGs, in community-based (govt-driven), micro-planning exercises (feeding into the GPDP?).

7. Next step to validate hypothesis

Tarava Panchayat Overview

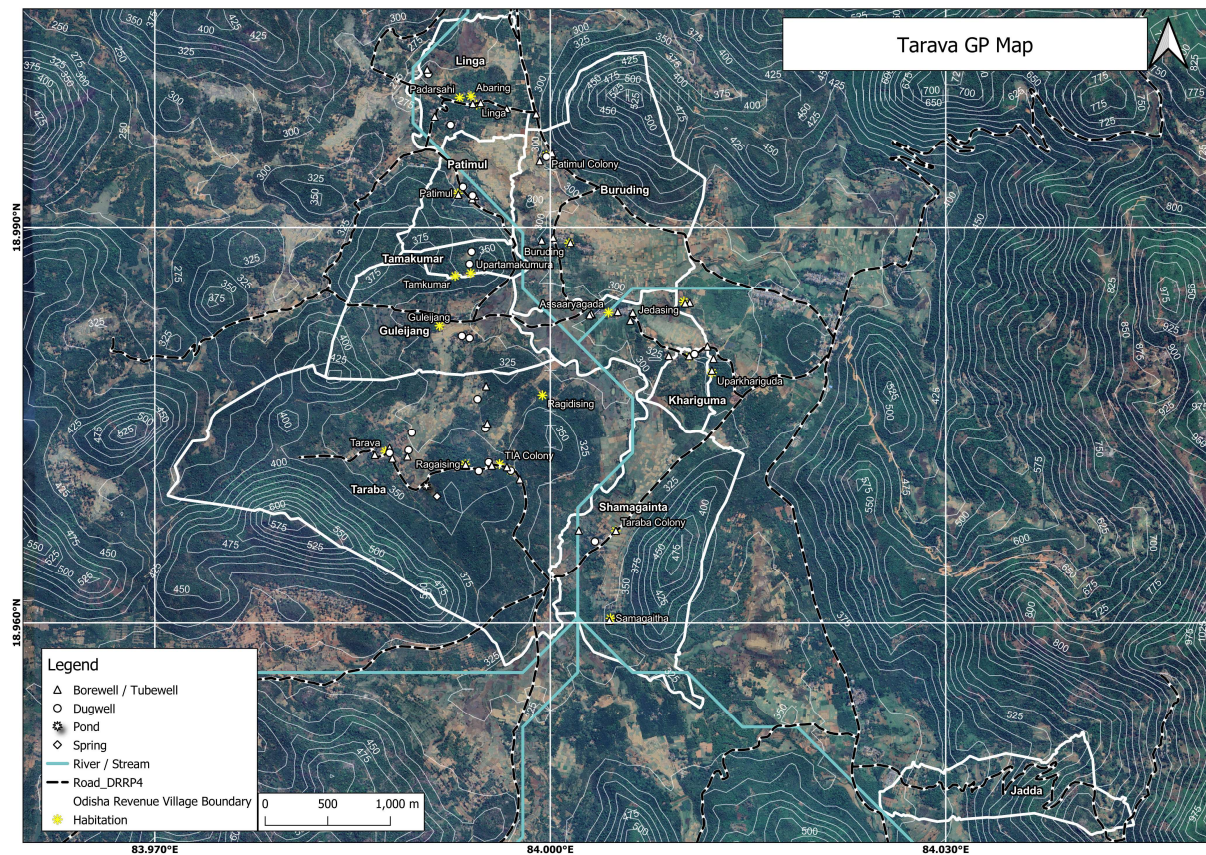


Figure 4: Gumma Revenue boundaries (map: courtesy Gram Vikas)

The map above overlays revenue boundaries and landform details, roads and water sources. The blue line indicates a stream/river (one can see the watershed details in the topographic map that follows). Some more information on watershed and irrigation activity may be useful, eg., checkdams and canal irrigation systems.

Table 11: Villagewise geographical area, households and population of Tarav GP

Village Name	Total Geog Area (in Hectares)	Total Household	Density hh/ sq km 100ha =1 sqkm	Total Population of Village	Density ppl/sqkm 100ha =1 sqkm	Pop as % of total GP popn	males/female	Total Scheduled Tribes Population
Buruding	581	91	15.7	433	74.5	12	1.1	428
Tamkumar	59	14	23.7	62	105.1	2	0.8	58
Patimul	167	80	47.9	352	210.8	10	1.0	350
Linga	205	81	39.5	345	168.3	9	1.1	345
Gulaijang	320	34	10.6	139	43.4	4	1.3	135
Taraba	1334	191	14.3	961	72.0	26	0.9	941
Ashrayagada	185	185	100.0	962	520.0	26	1.0	0
Khariguda	60	46	76.7	220	366.7	6	1.0	219
Samagainta	508	48	9.4	181	35.6	5	1.1	179
	3419	770	22.5	3655	106.9		1.01	2655

Census 2011

Density growth in Gajapati from 120 persons per sqkm to 134 person per sqkm (Odisha recorded 269 persons/sqkm as per 2011 census). Tarava as per 2011 census has recorded 107 persons per sqkm, which is much lower than the district average. Figures 5-6 and Tables 12-13, that follow, summarize the land-use information from the Census and ORSAC websites and identify the share of each village in the overall geographical area of Tarava Gram Panchayat. Tarava has 57% forested area and 32% net-sown area (total=57+32=89%) as per the Census information. ORSAC Level 1 data includes both these in the Green zone area and is 91%.

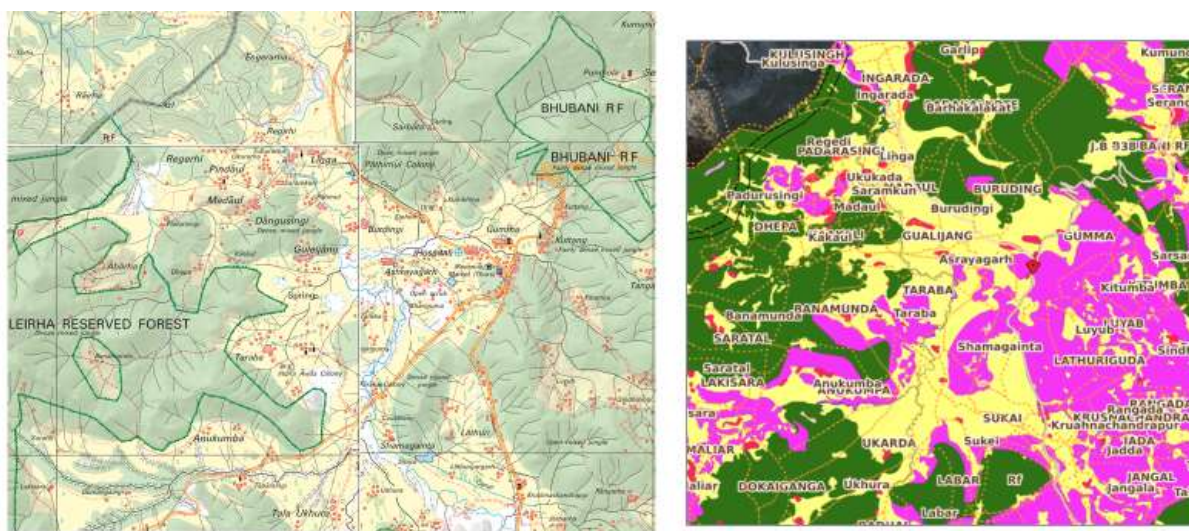


Figure 5: Topo map of Tarava GP and land use map (yellow: agriculture, Pink: scrub; Green: tree covered: settlement)

Table 12 : Land use as per Census 2011 data

Village Name Area in Hectares	Total Geographical	Forest	Area under Non-Agricultural Uses	Barren & Uncultivable Land	Permanent Pastures and Other Grazing Land	Land Under Miscellaneous Crops etc. Area	Culturable Waste Land Area	Fallow Land other than Current Fallows	Current Fallows Area	Net Area Sown	Total Unirrigated Land Area	Area Irrigated by Source	Canals
Buruding	581	34.6	7.3	248.4	14.0	0.0	0.0	17.7	0.0	259.0	114.3	144.7	144.7
Tamkumar	59	13.7	1.3	12.0	14.9	0.0	0.0	0.0	0.0	17.1	17.1	0.0	0.0
Patimul	167	7.5	3.4	67.1	4.3	0.0	0.0	1.7	0.0	83.2	37.7	45.5	45.5
Linga	205	9.3	5.7	22.1	7.3	0.0	0.0	8.1	0.0	152.5	84.8	67.7	67.7
Gulaijang	320	36.4	7.7	134.9	10.1	0.0	0.0	24.8	0.0	106.1	106.1	0.0	0.0
Taraba	1334	763.5	22.7	72.5	33.4	0.0	0.0	12.0	0.0	429.9	429.9	0.0	0.0
Ashrayagada	185	19.2	7.0	46.5	6.0	0.0	0.0	6.4	0.0	99.9	99.9	0.0	0.0
Khariguda	60	7.4	0.8	7.3	5.9	0.0	0.0	3.8	0.0	34.9	34.9	0.0	0.0
Samagaintha	508	81.3	4.5	225.6	12.2	0.0	0.0	34.2	0.0	150.1	150.1	0.0	0.0
Total	3419	972.7	60.4	836.4	108.1	0.0	0.0	108.6	0.0	1332.8	1074.9	257.9	257.9
Land use of Tarava GP		28%	2%	24%	3%			3%	0%	39%			
Tarava GP as % of particular land use in GP		78%	38%	9%	31%			11%		32%	40%		
Land use within Tarava village		57%	2%	5%	3%			1%	0%	32%			

Reference year 2009; DH_2011_DCHB_Village_Release_2100; <https://censusindia.gov.in/nada/index.php/catalog/932>

Table 13: Level 1 Land use of Tarava GP as per ORSAC 4k Geo

LULC Area in hectare	Gajapati	Gumma Block	Tarava GP	Ashryagada	Buruding	Guleijung	Jadda	Kharigumma	Linga	Patimul	Shamegainta	Taraba	Tamakumar	All villages	
Category														Sum	%
Built Up Land		985.29	48.18	4.47	7.17	3.90	5.23	0.59	3.28	1.50	5.33	16.16	0.55	48.18	2.8%
Nonbuilt-Up Land (Green Zone Areas)		45799.49	1543.28	55.22	239.41	136.85	100.09	26.67	86.98	67.61	208.88	596.39	25.19	1543.29	90.6%
Nonbuilt-Up Land (Underutilised Lands And Mining Lands)		5245.43	70.09	20.00	18.41	6.17	0.81	0.62	0.96	3.55	12.06	7.12	0.41	70.11	4.1%
Nonbuilt-Up Land (Water-Bodies And Wetland Areas)		431.59	34.30	4.11	4.83	1.16			3.10	2.53	11.60	6.68	0.28	34.29	2.0%
Others		47.63	1.26		1.08	0.08		0.03	0.04	0.00	0.06			1.29	0.1%
Vacant Land		490.60	6.42	0.34	1.95	0.94			1.54	0.67	0.15	0.80	0.01	6.40	0.4%
Totals	432499	53000.03	1703.53	84.14	272.85	149.10	106.13	27.91	95.90	75.86	238.08	627.15	26.44	1703.56	
Percentage of Tarava GP area				5%	16%	9%	6%	2%	6%	4%	14%	37%	2%		
Percentage of Gumma Block Area			3.2	0.16	0.51	0.28	0.20	0.05	0.18	0.14	0.45	1.18	0.05	3.21	
Gumma as a percent of Gajapati		12.3													
Tarava GP as a percent of Gajapati		0.39													



Figure 6: Google Earth image of Tarava village cluster: Tarava badasahi, Tarava Colony and Tarava Indira Awas Colony

Tarava and Buruding identified as growth centres

Villages Tarava and Buruding together occupy the largest percentage of land area in the GP (53-56% ORSAC-Census data; see Tables 13, 14) and populationwise also contribute to over 40% of the total GPs population (730+445=1175/2783). Surveys will begin with Tarava and Buruding, and expanded as needed.

The household survey will initially focus on two revenue villages, Tarava and Buruding and will be carried out at the habitation level including Tarava badasahi, TIA colony and Tarava Colony, and Samagaitha because of proximity and sharing the same church. Buruding will be surveyed and villages that are related to it may be included (for e.g., Patimul colony villagers mentioned that their khasra/revenue maps fall within Buruding, but this has to be verified as it does not appear so from the ORSAC revenue maps).

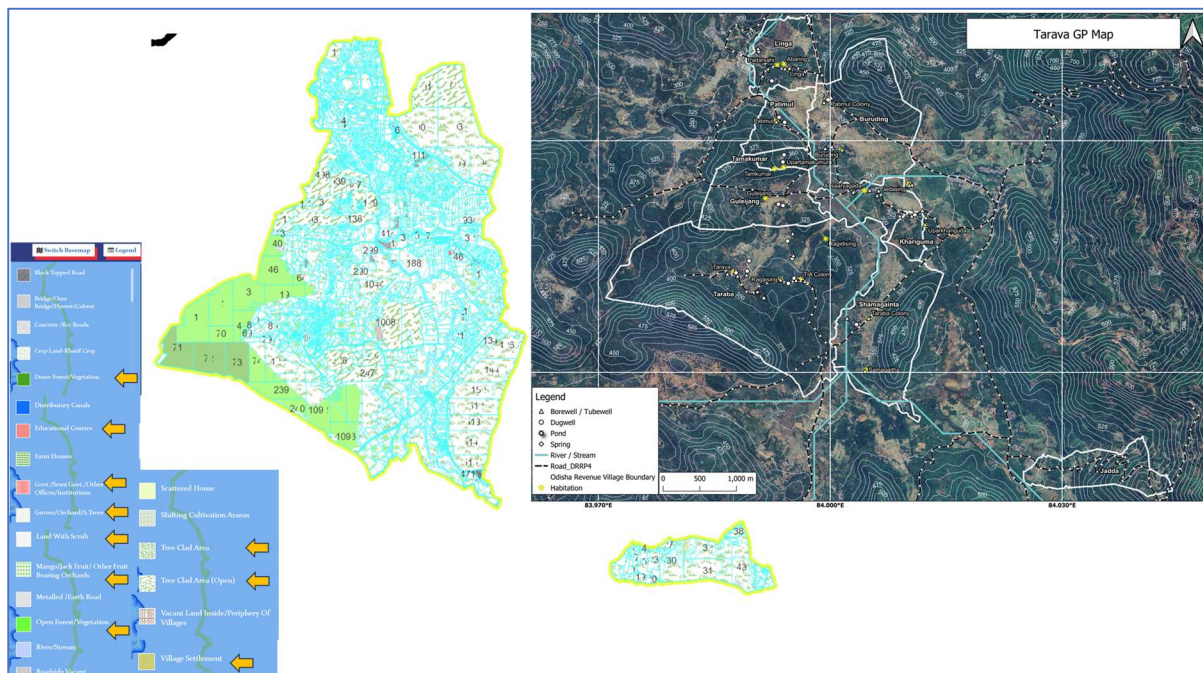


Figure 7: Cadastral map of Gumma showing land use along with the habitation wise map of Gumma (developed by GV)

Table 14: Land use details (Lv1) of three Revenue Villages to be surveyed (based on ORSACs 4K Geo website)

LULC Area in hectare	Tarava GP		Buruding		Shamagainta		Taraba		All villages	
Category	LULC Area	% of village total	LULC Area	% of village total	LULC Area		LULC Area	% of village total	Sum	% of Block total
Built Up Land	48.18	2.8%	7.17	2.6%	5.33	2.2%	16.16	2.6%	48.18	3%
Nonbuilt-Up Land (Green Zone Areas)	1543.28	90.6%	239.41	87.7%	208.88	87.7%	596.39	95.1%	1543.29	91%
Nonbuilt-Up Land (Underutilised Lands & Mining Lands)	70.09	4.1%	18.41	6.7%	12.06	5.1%	7.12	1.1%	70.11	4%
Nonbuilt-Up Land (Water-Bodies And Wetland Areas)	34.30	2.0%	4.83	1.8%	11.60	4.9%	6.68	1.1%	34.29	2%
Others	1.26	0.1%	1.08	0.4%	0.06	0.0%		0.0%	1.29	0%
Vacant Land	6.42	0.4%	1.95	0.7%	0.15	0.1%	0.80	0.1%	6.40	0%
Totals	1703.53		272.85		238.08		627.15		1703.56	
Percentage of Tarava GP area			16%		14%		37%			
Percentage of Gumma Block Area	3.2%		0.51%		0.45%		1.18%		3.21%	

Tarava Village

Table 15: Development Timeline of Tarava village – a narrated history

Tarava Timeline: as narrated by Simia Bhuyan (48 years) and Gopan Bhuyan (53 years)		
1920-60	Food and housing were problems	
1950-60	Lanzia dress: Men wore langot; women a one-piece woven cloth of cotton and flax	
1961	Church (shared with Ragadasing) also same church as Samagaitha presently (In PKD in 1902) and Serango eye hospital 1923- Canadian Baptist)p.130, Gazetteer)	Forest-based
1964	Separate Gumma Block formation (Ganjam District); (likely 1951?) Dug well and drinking water in Tarava	
1969	Road PWD: Gaiba to Tarava	
1970	Migration begins	
1971	01-06-1971: Tarava Primary School	Slash-burn
1974-75	2 acre/family: 100 families given land from Revenue forest	
1977	Patta survey-ghar Jameen, then billa jameen was less	
1977	2 acres for playground near church from Gramya jungle	
1978	Tarava Colony: Kutir Jyoti (at least 80-year-old village)	
1980s	Food: Solpo Jauw, mandia jauw and food collected from the jungle.	
1985s	After conversion to Christian villagers gave up old way of dressing	
1990s	Left traditional food and started eating rice	
1990	Development by Government, IAY housing and land development Electricity. Horticulture department introduced cashew TIA colony (from Regasing – 100-year-old village and Ragadising also 100 year old)	Settled Agri-Horticulture
1992	02Oct92 Gajapati became an independent district bifurcated from Ganjam	
1994-95	Population increases: 10 years before this each family had 5 to 10 kids 108 houses 717 population: under church	
1997	Bogodo crops: Kundu Dhana (has disappeared) Used to grow, tilla, biri, ganga, mandia, Jonna, kangu	
1997	Ghosti jagah: 9 acres from Gramya Jungle: FRA; for community work As /Gazetteer (p.24) Rubber was introduced in 2 villages of Gumma in 1997-98	
1998	Settled agriculture – Now Billas, previously only Badas before 1998-99 jungle safa kolu.	
2000	FRA pattas Horticulture increases	
2001	Separate Gumma Panchayat formed (2002?) Forest department. KMDS/ADS (In Buruding in the 1980s) TBR: RHEP Gram Vikas;	Ext-Agency
	2005-2006: SHG group through Gram Vikas	
2006	FRA 2005 (cut of date 13Dec2005) comes into effect	
2008	Gumma tahsil created block was existing	
2012	Jungle Jameen patta – FRA	MSME-FPOs
2014	Rubber Plantation (Rubber Board through ITDA); Family planning begins	
2016	Migration to Bombay and Chennai at its peak	
2019-20	More patta 153 people: outside people also included in Tarava colony	
2021	Metered electricity	

The table shows the three stages of development of Tarava village (1) Forest-based (2) Agriculture-based (2) Industrial-orientation. Each of these will have different implications on distances travelled by the inhabitants (especially after the introduction of motorized vehicles) and per-capita resource consumption, as well on the well-being of the community and the ecosystem. **Some of the time-period of milestones/landmark events will have to be verified/validated.**

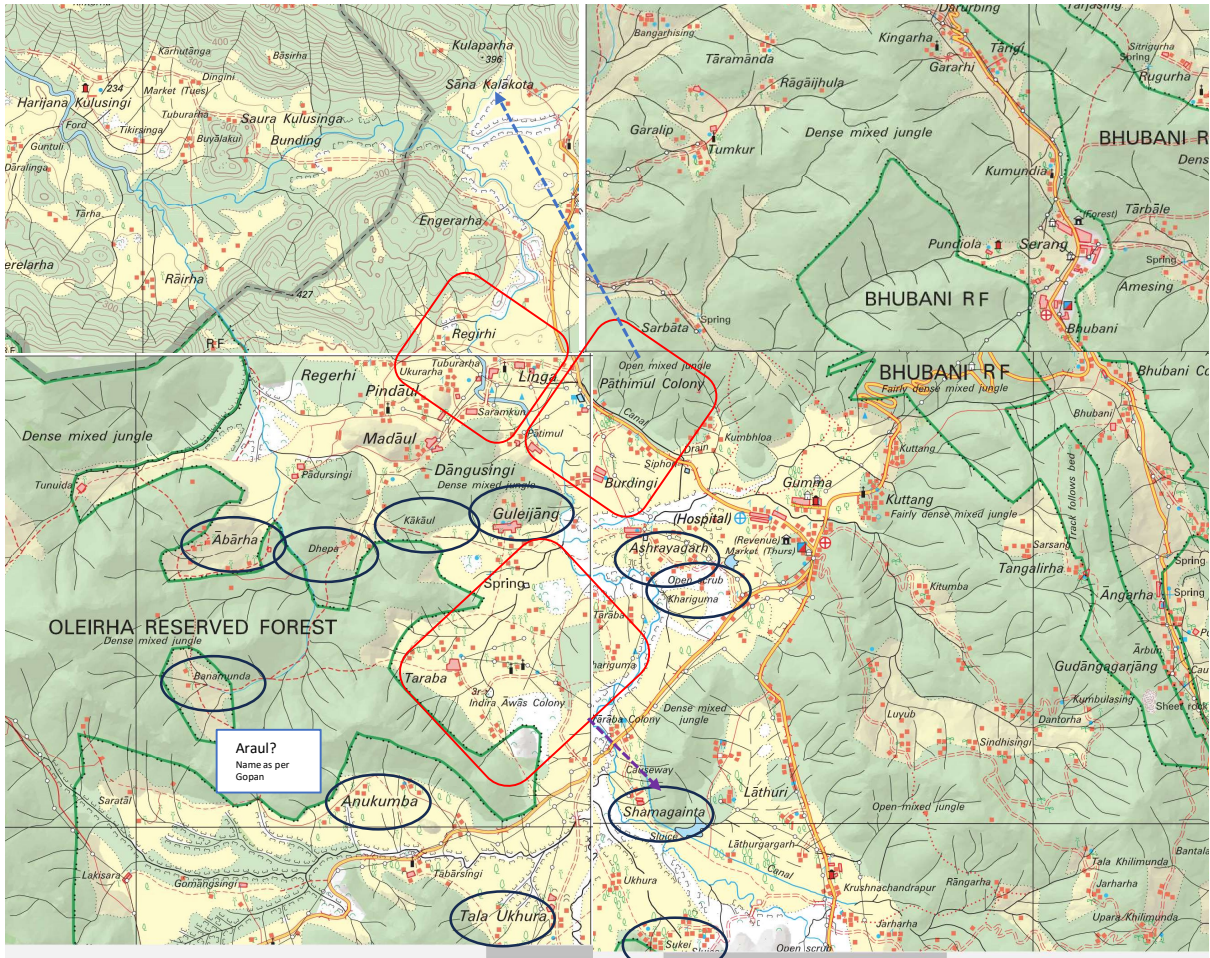


Figure 8: Topo sheet showing Tarava village along with the immediate neighbours that share its boundaries

Village Resource map seen w/Google image on right-side

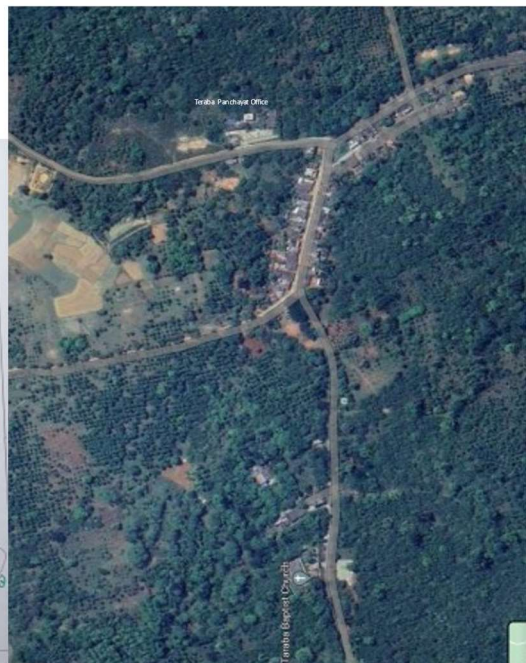


Figure 9: Resource map of Tarava village alongside with Google imagery indicating the linear development profile of village

These are useful base maps that can be further enriched with quantitative information from the household survey indicating material movement, travel distances as well as resource consumption for subsistence as well as livelihood activities.

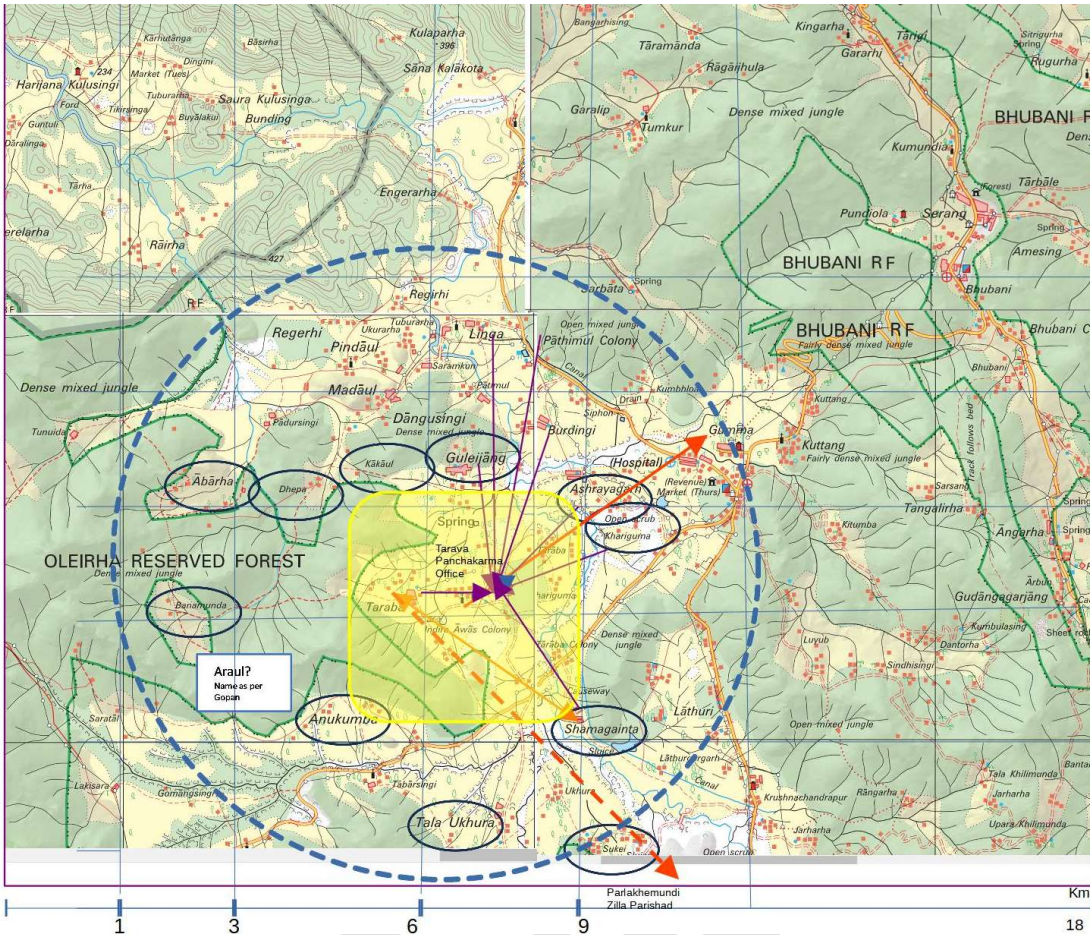


Figure 10: Tarava village and the growth of the boundaries of influence with development (based on Doxiadis)

This map indicates distance travelled currently based on a discussion in Tarava. A historical and future map could be developed along with computing the percapita Energy, Water/Net Carbon consumption in the village after a household survey.

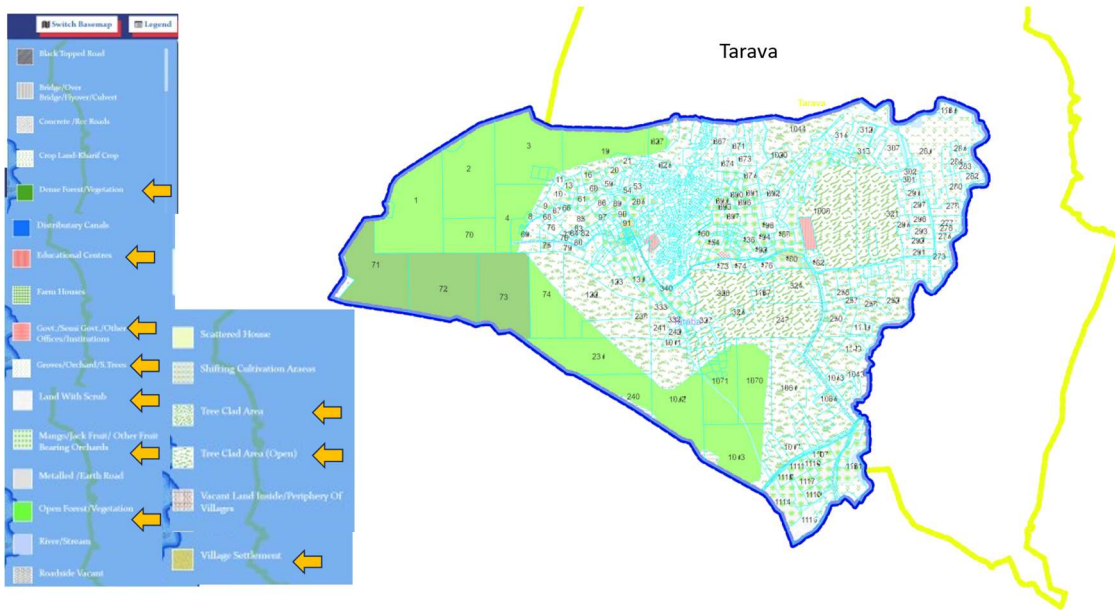


Figure 11: Land-use indicated on the cadastral map of Tarava village. Orange arrows indicate the relevant land-use classification

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APPENDIX

APPENDIX 1: List of households selected for survey during village discussions

SN	SN/ GV survey	Revenue village	Habitation	household number	Name of the primary head of household	Gender	Primary occupation of the household head
1	144	Burudinga	Buridinga	12	Gopi gamanga	Male	Agricultural Labor
2	146	Burudinga	Buridinga	7	Saimon Bhuyan	Male	Non-agricultural labor
3	152	Burudinga	Buridinga	15	Daipan gamanga	Male	Agricultural Labor
4	159	Burudinga	Buridinga	14	Ayub Gamanga	Male	Agricultural Labor
5	224	Burudinga	Buridinga	38	Rihabiam gamanga	Male	Non-agricultural labor
6	226	Burudinga	Buridinga	40	Sulaman raita	Male	Non-agricultural labor
7	255	Burudinga	Buridinga	51	Jemesh Bhuyan	Male	Non-agricultural labor
8	257	Burudinga	Buridinga	62	Thumas Gamango	Male	Non-agricultural labor
9	263	Burudinga	Buridinga	57	Stipan Gamango	Male	Non-agricultural labor
10	267	Burudinga	Buridinga	60	Jakuba Gamango	Male	Non-agricultural labor
11	268	Burudinga	Buridinga	61	Serapai Gamango	Male	Non-agricultural labor
12	271	Burudinga	Buridinga	65	Puina Gamango	Male	Non-agricultural labor
13	278	Burudinga	Buridinga	27	Alispan gamanga	Male	Agricultural Labor
14	282	Burudinga	Buridinga	17	Lebiya gamanga	Male	Cultivation
15	294	Burudinga	Buridinga	26	Ezikel gamanga	Male	Cultivation
16	297	Burudinga	Buridinga	33	Honok gamanga	Male	Agricultural Labor
17	303	Burudinga	Buridinga	22	Sunil gamanga	Male	Cultivation
18	310	Burudinga	Buridinga	93	Kakiya Bhuyan	Male	Agricultural Labor
19	311	Burudinga	Buridinga	92	Labi bhunya	Male	Cultivation
20	131	Burudinga	Kumbiba	78	Abadiya gamanga	Male	Agricultural Labor
21	135	Burudinga	Kumbiba	83	Silbana gamanga	Male	Agricultural Labor
22	249	Burudinga	Kumbiba	74	Nimiya gamanga	Male	Non-agricultural labor
23	400	Samagaitha	Samagaitha	7	Jabnu nayaka	Male	Agricultural Labor
24	430	Samagaitha	Samagaitha	19	Ajita nayak	Male	Cultivation
25	434	Samagaitha	Samagaitha	15	Lila naika	Female	Agricultural Labor
26	435	Samagaitha	Samagaitha	14	John turmen naika	Male	Non-agricultural labor
27	467	Samagaitha	Samagaitha	28	Sipaniya Naik	Male	Agricultural Labor
28	475	Samagaitha	Samagaitha	31	Abiram Naik	Male	Agricultural Labor
29	528	Samagaitha	Samagaitha	37	Tiaphil nayak	Male	Agricultural Labor
30	479	Taraba	Indrabas Colony /Taraba Colony	35	Abhinas bhuya	Male	Agricultural Labor
31	481	Taraba	Indrabas Colony /Taraba Colony	36	Joshep mandal	Male	Agricultural Labor
32	489	Taraba	Indrabas Colony /Taraba Colony	33	E. B jasmin mandala	Male	Agricultural Labor
33	499	Taraba	Indrabas Colony /Taraba Colony	24	Saiman mandala	Male	Cultivation
34	543	Taraba	Indrabas Colony /Taraba Colony	18	Asish bhuyang	Male	Agricultural Labor
35	545	Taraba	Indrabas Colony /Taraba Colony	20	Vijaya nayak	Male	Agricultural Labor
36	615	Tarava	Ragaising	7	Abila raita	Female	Non-agricultural labor
37	616	Tarava	Ragaising	8	Gami raita	Male	Agricultural Labor
38	634	Tarava	Ragaising	1	Jai raita	Male	Agricultural Labor
39	416	Tarava	Taraba Colony	21	Nibaru mandal	Male	Agricultural Labor
40	424	Tarava	Taraba Colony	29	Simiya Gamanga	Male	Agricultural Labor
41	444	Tarava	Taraba Colony	36	Apala naika	Male	Cultivation
42	566	Tarava	Taraba Colony	11	Labara bhuyang	Male	Agricultural Labor
43	569	Tarava	Taraba Colony	14	Junash mandal	Male	Agricultural Labor
44	570	Tarava	Taraba Colony	15	Daipa mandal	Male	Agricultural Labor
45	554	Tarava	Tarava	29	Pital bhunya	Male	Agricultural Labor
46	580	Tarava	Tarava	6	Mongsira bhuya	Male	Agricultural Labor
47	583	Tarava	Tarava	1	Jikariya bhuya	Male	Agricultural Labor
48	591	Tarava	Tarava	16	Suresh bhuya	Male	Non-agricultural labor
49	595	Tarava	Tarava	36	Bhagya bhunya	Male	Agricultural Labor
50	620	Tarava	Tarava	53	Jidi bhuyang	Male	Agricultural Labor
51	623	Tarava	Tarava	55	Abrung bhuyang	Male	Agricultural Labor
52	624	Tarava	Tarava	56	Junash gamango	Male	Agricultural Labor
53	629	Tarava	Tarava	61	Nagar gamango	Male	Agricultural Labor



LEARN LEAD SERVE

SRI SRI UNIVERSITY

16-Aug-23

To,
The CE,
ORSAC, Bhubaneswar,

Dear Sir,

I am following up on my earlier email dated 17-July-2023 requesting assistance with satellite maps.

As already mentioned, I am doing a study on the growth patterns of Tarava Gram Panchayat of Gumma Block, in Gajapati district of Odisha for which I needed and found the cadastral level maps on your Odisha4kgeo very useful. However these maps are not downloadable. It would be very useful for my research to have the shape/API files.

I had a very useful discussion with Senior Scientist SK Parida regarding specific requirements for my research and availability of information, on 11-Aug 23, at ORSAC, Bhubaneswar.

In continuation with my discussion I would like to request for my research purposes, shape files of the **Tarava Gram Panchayat of Gumma block of Gajapati district** for the following three time periods in the scale at which they are readily available:

1. LULC maps for the year **2008-2009 and 2018-19** developed as a part of (SSIDP) Govt. of India Directorate of Space project
2. LULC for the year **2015-16** developed for Odisha 4KGeo website

Thank you for your assistance.

Warm Regards,

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B. Arch, MES, Ph. D
Prof.@ Sri Sri University, Cuttack
and Independent Researcher