Rejuvenating Traditional Tanks in Bundelkhand Using Integrated Participatory Approach

Prepared By

ARID COMMUNITIES & TECHNOLOGIES

Submitted to

srijan सृजन

Self-Reliant Initiatives through Joint Action

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Arid Communities and Technologies

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Executive Summary

Bundelkhand region consists of 14 districts spread across Madhya Pradesh and Uttar Pradesh. Climatically the region is semi-arid and hot with an average annual rainfall between 760 mm (lowest) to 1227mm (highest). About 90% of rainfall is received during the monsoon season. Geologically the region comprises dominantly of hard rocks in the middle and south and loose alluviums in the north. The region has unique traditional rainwater harvesting systems built by erstwhile Bundela and Chandela rulers. These water harvesting structures have traditionally provided drinking water security in the region, critical irrigation, groundwater recharge and reduced runoff. Across the region, there are many such structures built to meet the region water needs. These traditional water structures are broadly of two types" cascade tank networks and standalone structures.

Over time, these traditional water systems have been modified. Currently, large standalone structures are managed by the irrigation department and modified for irrigation management by canals. However, many small tanks built in cascade style are used and managed by local communities. The latter has management practices that need attention to improve resource utilization, water use efficiency and agriculture livelihood sustainability. In 2019, SRIJAN and Hindustan Unilever Foundation started the tank rejuvenation program in seven districts of Bundelkhand. Its outcome has been very encouraging not only for water security in the region but also in improving agriculture livelihood income generation and sustainable livelihood to the rural communities.

It is in this context that a study grant with the HUF was proposed to document the technical trend, pattern of water usage and emerging issues around its maintenance. The study team selected eight cascade tanks" Belatal and Arjunsagar cascades in Mahoba, Chhota Bada Talab and Arjar Tank cascades in Niwari district, Dharamsagar and Barhora in Tikamgarh, Barethi tank cascade in Chhatarpur and Gunta cascade in Chitrakoot district. The cascade selection process was based on the detailed study of each cascade with primary data on inflow, outflow, channels, catchment area characterization, groundwater influence zone mapping, management and other vital details. This study documents the primary and regional data for each of the eight cascades, their respective status and rejuvenation plan. It was found that management of traditional tanks in Bundelkhand have been neglected due to various reasons. Presently, there is a need for holistic management of these natural resources especially in the context of changing climate. Areas that demand intervention includes (1) catchment and tank infrastructure management (2) efficiency in water use and equitable distribution (3) community ownership and collective management.

The blueprint provides a comprehensive approach for stabilising agriculture and rejuvenation of traditional tanks in tandem. Across the program districts, tank rejuvenation work has addressed local concerns around water and agriculture livelihoods through awareness, action, and support from community institutions. The communities have continued to show a high level of acceptance and even keenness to benefit from a project of this kind, as it successfully generated employment opportunities in the short term while enhancing opportunities for better livelihoods. In the community's endeavor of strengthening their livelihoods and securing themselves from shocks of climate change, the programme focussed on building capacities of the communities while leveraging their tradition of collective action. Community participation, contribution and ownership have been key pillars on which the all-round change has been brought about. This transformation is manifested in strengthened agriculture in the form of orchards, multi-layer vegetable cultivation plots and rejuvenated farms. Over a period, tank restoration along with agriculture improvement largely focussing on natural farming has helped revive the entire economy of the programme villages.

Traditional tanks and other surface water bodies are now seen as community assets to be managed collectively. Silt application followed by natural farming has helped enhance productivity. More investments are now being made in terms of time, efforts and resources. All of this has led to efficient use of water and its equitable distribution. Some of the rejuvenated tanks from the program are part of a larger cascade and their operational methodology can be extended to enhance the overall impact of the cascade. These traditional water harvesting structures are broadly categorized into standalone and a network of small and big tanks.

1. Introduction

1.1 Background

Bundelkhand is a water-deficient region where drought has been a recurrent phenomenon for ages. To facilitate habitation, the Bundela and Chandela rulers developed water harvesting structures from 8 AD to 13 AD. These structures were developed considering various aspects such as local climatic, geological, geomorphological, environmental and livelihood characteristics. These time-tested water harvesting structures have contributed immensely to the needs of the people by capturing the runoff. In this rain-deficient region with limited groundwater availability, these structures have provided water for drinking, domestic needs, and irrigation.

These traditional water harvesting structures are broadly categorized into standalone and a network of small and big tanks. Over the years, owing to a lack of people's participation in their upkeep, management, and other anthropogenic reasons, the efficient utilization of these structures has diminished. However, these tanks are still very relevant for the region's water security in the face of growing vagaries of climate change seen as more frequent drought, erratic precipitation patterns, the growing numbers of hot days and high-intensity rainfall in short spurts. Climate change portends severe water security concerns for the region, which has historically relied on stored rainwater.

1.2 The Study

In selected districts of the Bundelkhand region of Uttar Pradesh and Madhya Pradesh in 2019, Hindustan Unilever Foundation (HUF) and SRIJAN initiated a program titled "Reviving Bundelkhand's Traditional Tanks through Community-led Action to Stabilise Agricultural Livelihoods in a region vulnerable to chronic water distress". This Blueprint is an effort to understand the pattern, layout and status of tanks developed in a cascade or network manner towards ensuring sustainable water management. This document also captures the experiences gained from field implementation towards an approach to tank rejuvenation in a comprehensive manner.

The blueprint holistically approaches the rejuvenation of tanks in the region, taking cognizance of all stakeholders. It captures:

- Sustainable management of tanks and network of tanks in the region based on regional hydrogeological factors.
- Participatory planning for cascade tank revival and
- Decentralized water management process.

2. The Geohydrological Characteristics of Bundelkhand

Bundelkhand is a semi-arid region prone to droughts. The area witnesses hot to very hot summers, late onset of monsoons, long dry spells between rainfalls and high rainfall during monsoons. The rocky, hilly terrain in the region has a high runoff ratio. Almost 70% of hard rock formations (non-permeable strata) limit groundwater recharge and groundwater availability is only at shallow aquifer levels and in limited pockets. The change in climate over the years has aggravated the problem.

2.1 Location

Bundelkhand is a cultural and geographic region located in the central-northern India. It falls in Madhya Pradesh and Uttar Pradesh. It encompasses 13 districts. The northern 07 districts are in Uttar Pradesh, and the southern 06 in Madhya Pradesh (Fig. 2.1). The region covers 70,747 sq. km, largely mountainous or hilly.

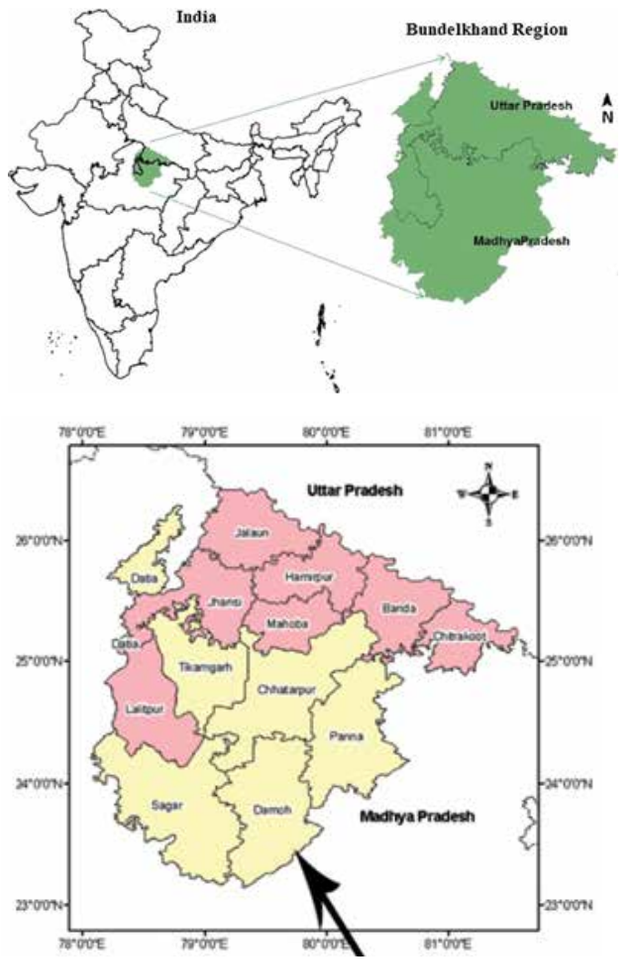


Fig. 2.1 Location Map of Bundelkhand Region

2.2 Climate

Climatically, the Bundelkhand region is characterized as drought-prone, semi-arid, with a hot climate. Average annual rainfall over the region varies from 760 mm (lowest) to 1227 mm (highest) Fig 2.2. About 90% of the annual rainfall is received during the monsoon season. Sometimes, spells of high-intensity rain led to floods in the region during monsoon season.

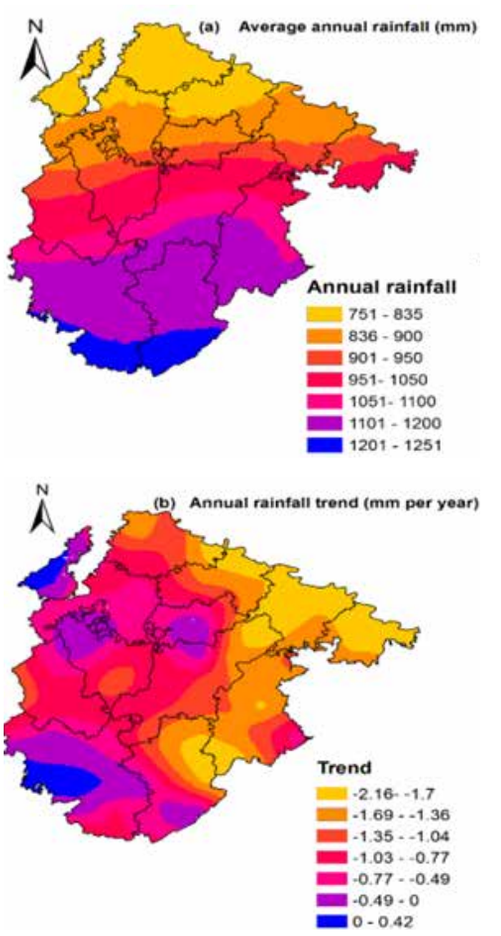


Fig. 2.2 Average Annual Rainfall and Changing Trends in Average Annual Rainfall from Year 1901 to 2013 of Bundelkhand Region

2.3 Geology – Geohydrology

The Bundelkhand craton comprises five major geological divisions -Archaean to Paleo-Proterozoic (Bundelkhand massif), Paleo-Proterozoic (Bijawar and Gwalior groups), Meso-NeoProterozoic (Vindhyan Supergroup), Cretaceous (Deccan Traps), and Quaternary (Indo-Gangetic plains).

The region has several types of rock formations with varied properties in the context of groundwater. Mainly, the area has hard rocks that limit the availability of groundwater. BGC, Metasedimenta and granitoids have secondary porosity through fractures, cracks and weathered zones. Groundwater occurs in these zones in scattered patches. The sedimentary formation of sandstone has the

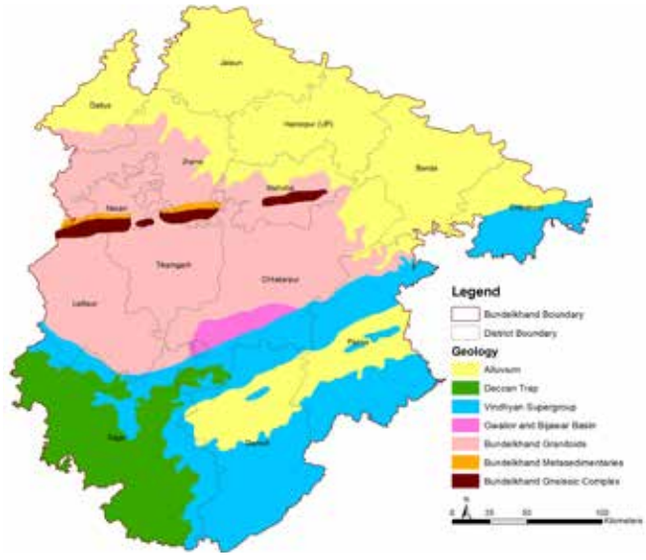


Fig. 2.3 Slope Categorization Bundelkhand Region

potential for groundwater at varying depths. The Deccan basalts also represent secondary porosity through joints, fractures and weathered zones. The basalt has good groundwater zones at shallow depths. The recent alluvial plain has excellent groundwater potential and represents shallow to deep aquifers depending on the thickness of alluvial formation. The aquifer systems yield moderate groundwater through dug wells and borewells. In hard rock regions, groundwater potential is limited to weathered zones of up to 20 - 40 meters depth.

2.4 Physiography and Slope

The Bundelkhand region represents beautiful mountain ranges, perennial rivers and fertile alluvial plains. The northern and central part is characterised by undulating alluvial plains at an elevation below 300 m. It covers 67% of the area (Singh, 1993). The remaining 23% of the region has an elevation ranging from 300 to more than 600 meters (Fig 2.4). This is the Vindhyachal range, stretched all along the southern part of the region.

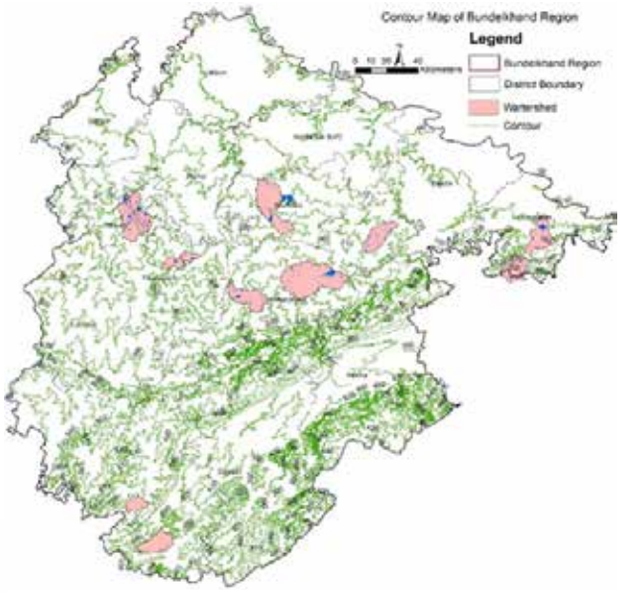


Fig. 2.4 Contour map of Bundelkhand Region

Looking at slope categorization, the northern area has a slope of below 5 degrees, the central uplands have a 5-to-30-degree slope, while the southern hill region slope is between 30 to >45 degrees (Fig. 2.5). The major river systems flow from the south of the mountain region to the northern alluvial plains.

2.5 Drainage and Watersheds

Bundelkhand region is in the central zone of India. It has a group of northbound perennial rivers paying tribute to the river Yamuna flowing along its northern border. The rivers flow from southwest to northeast. These rivers are the primary water source for both agriculture and domestic use. The primary perennial rivers of the region are the Yamuna, Ken, Betwa, Sind and Pahuj—other rivers are

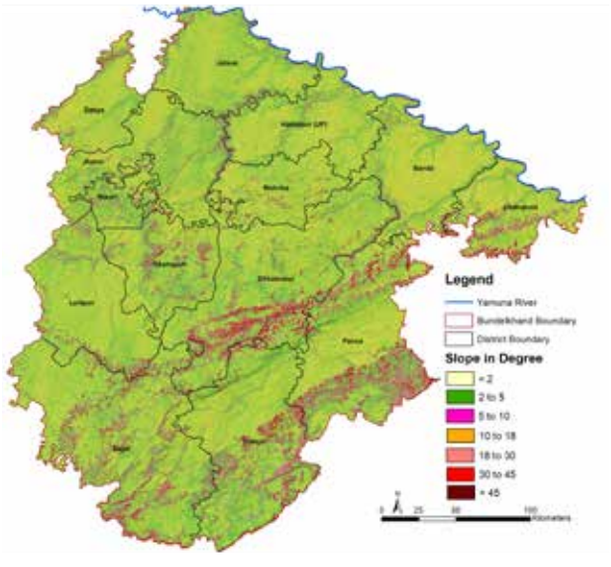


Fig. 2.5 Slope Categorization of Bundelkhand Region

Sind, Dhasan, Baghein, Paisuni and Tons (Fig 2.6).

Based on the major river systems, three watersheds are identified for the region (Fig 2.7). The Ken watershed covers the southeastern area. Betwa is a significant watershed and covers most of the central region. The northwest fringe of the region is the Sindh watershed. All these rivers flow into Yamuna in the north.

2.6 Land use and Water Resources

Based on the major river systems, three watersheds are identified for the region (Fig 2.7). The Ken watershed covers the southeastern area. Betwa is a significant watershed and covers most of the central region. The northwest fringe of the region is the Sindh watershed. All these rivers flow into Yamuna in the north.

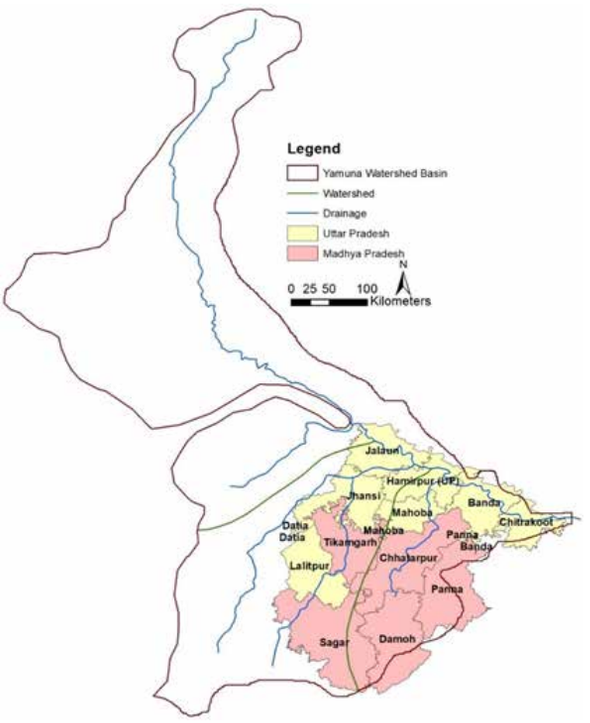


Fig. 2.6 Location of Bundelkhand in Yamuna Basin and Major Yamuna Tributaries Flowing through Bundelkhand Region

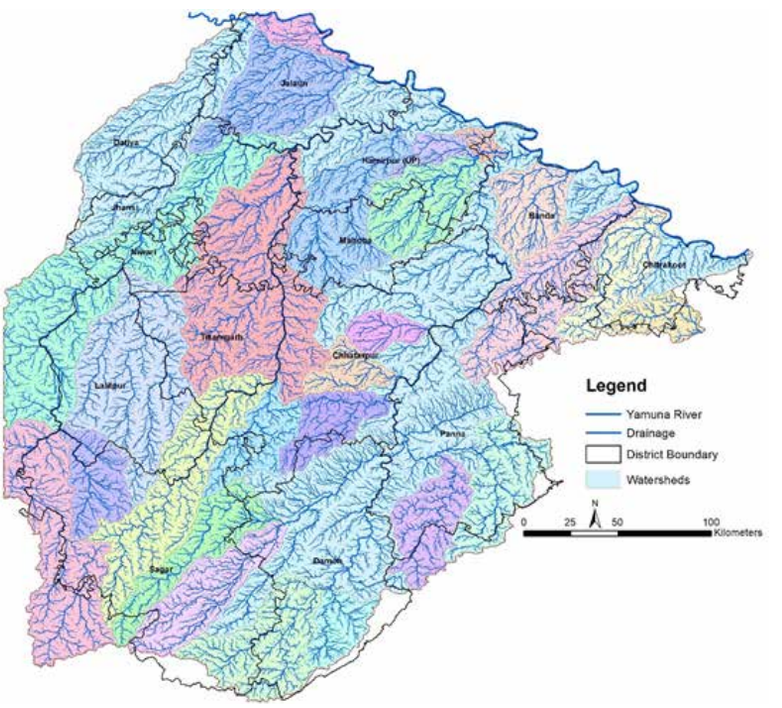
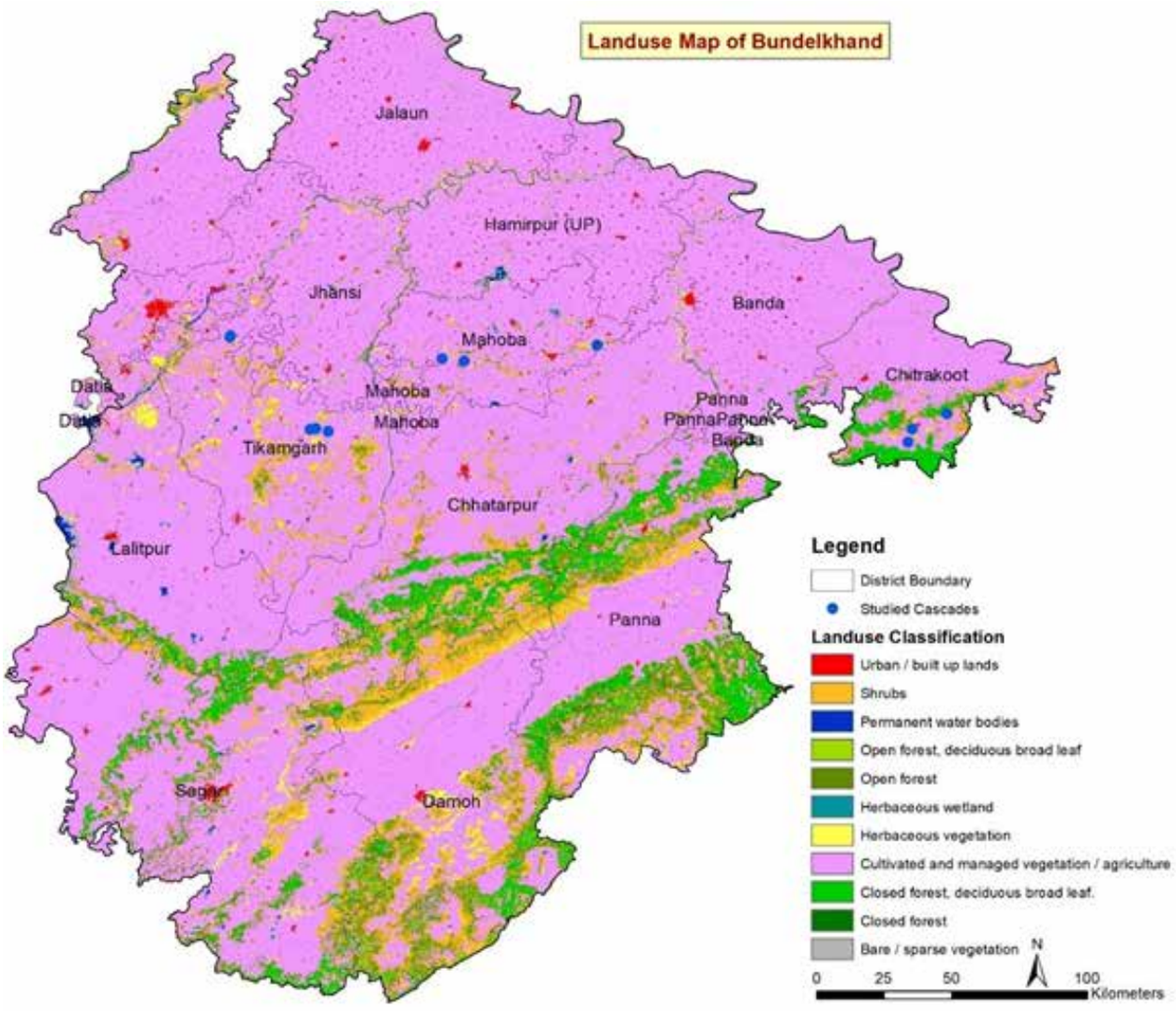


Fig. 2.7 Macro and Micro Watershed Characteristics of Bundelkhand Region



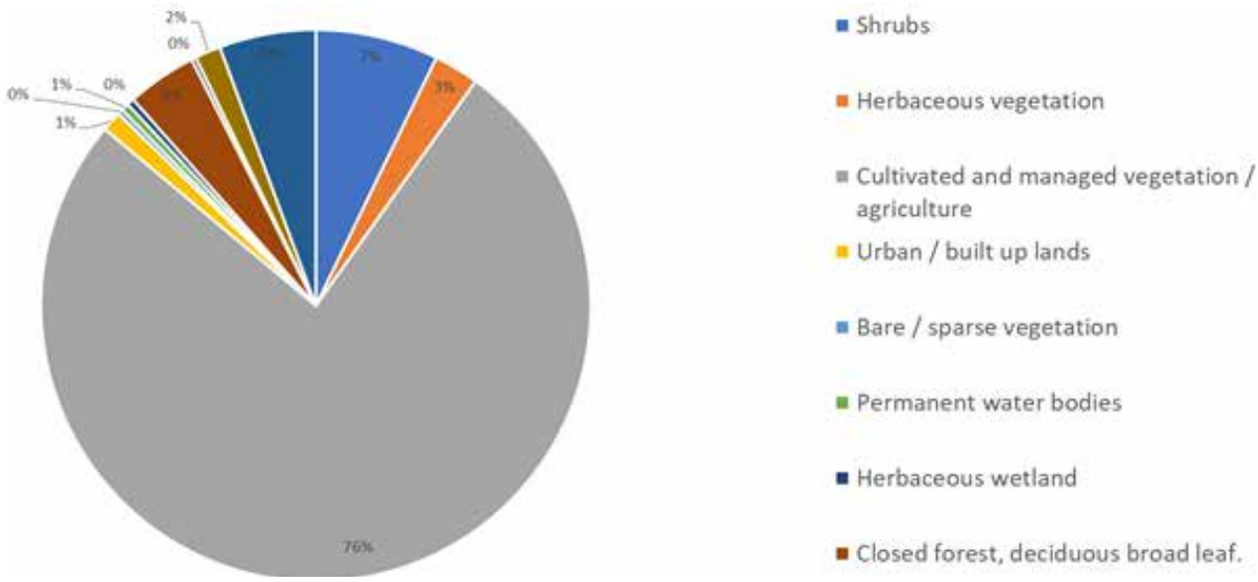


Fig. 2.8 Landuse Pattern in Bundelkhand

Table 2.1 Land Use Pattern of Bundelkhand

LAND USE	AREA (HA)	PERCENTAGE
Cultivated and managed vegetation / agriculture	5172675	76.18%
Shrubs	490729	7.23%
Open forest	385775	5.68%
Closed forest, deciduous broad leaf	278518	4.10%
Herbaceous vegetation	180267	2.65%
Open forest, deciduous broad leaf	102521	1.51%
Urban / built up lands	79982	1.18%
Permanent water bodies	31218	0.46%
Herbaceous wetland	28301	0.42%
Bare/sparse vegetation	21350	0.31%
Closed forest	18747	0.28
Total	**6790082**	**100%**

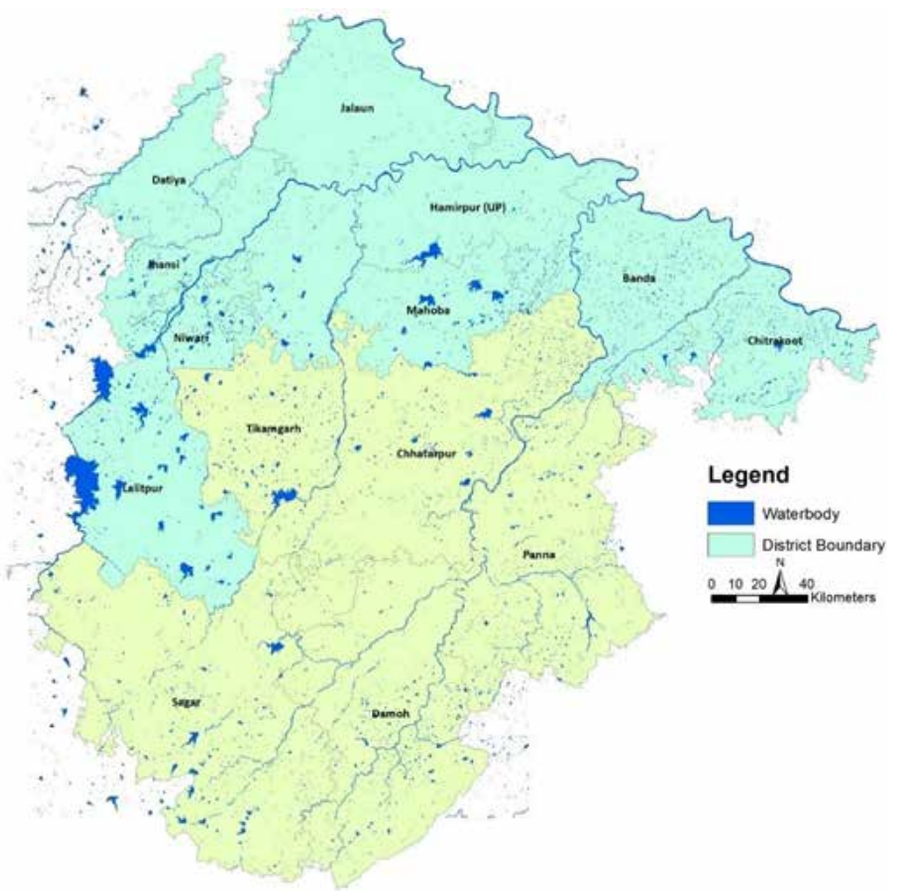


Fig. 2.9 District-wise Major Watershed wise Distribution of Water Bodies in Bundelkhand

Table 2.2 District wise Distribution of Water Body and Irrigated Areas

SR. NO	DISTRICT	WATERBODY (NO)	IRRIGATED AGRICULTURE AREA (HA)
1	Banda	1474	413409
2	Chhatarpur	1995	637491
3	Chitrakut	1051	227958
4	Damoh	1157	406472
5	Datiya	396	234440
6	Hamirpur	650	398623
7	Jalaun	352	428315
8	Jhansi	955	453525
9	Lalitpur	629	420738
10	Mahoba	598	26009
11	Niwari	421	102674
12	Panna	1585	363842
13	Sagar	1668	752026
14	Tikamgarh	616	307153
	TOTAL	13547	5172675

2.7 Soil

The soils in the Bundelkhand region have been developed by erosion of Deccan traps, Vindhyan rocks, Granites and Gneiss. The soils can be divided into two broad groups" (1) red and (2) black soils. Further the soil associations have been categorized in to four subdivisions fig 2.10.

(i) Bundelkhand-coarse grained-reddish brown soils (Rakar),
(ii) Bundelkhand-coarse grained-grey to greyish brown soils (Parua),
(iii) Bundelkhand-clay loam black soils (Kabar) and
(iv) Bundelkhand-fine clayey black soils (Mar)

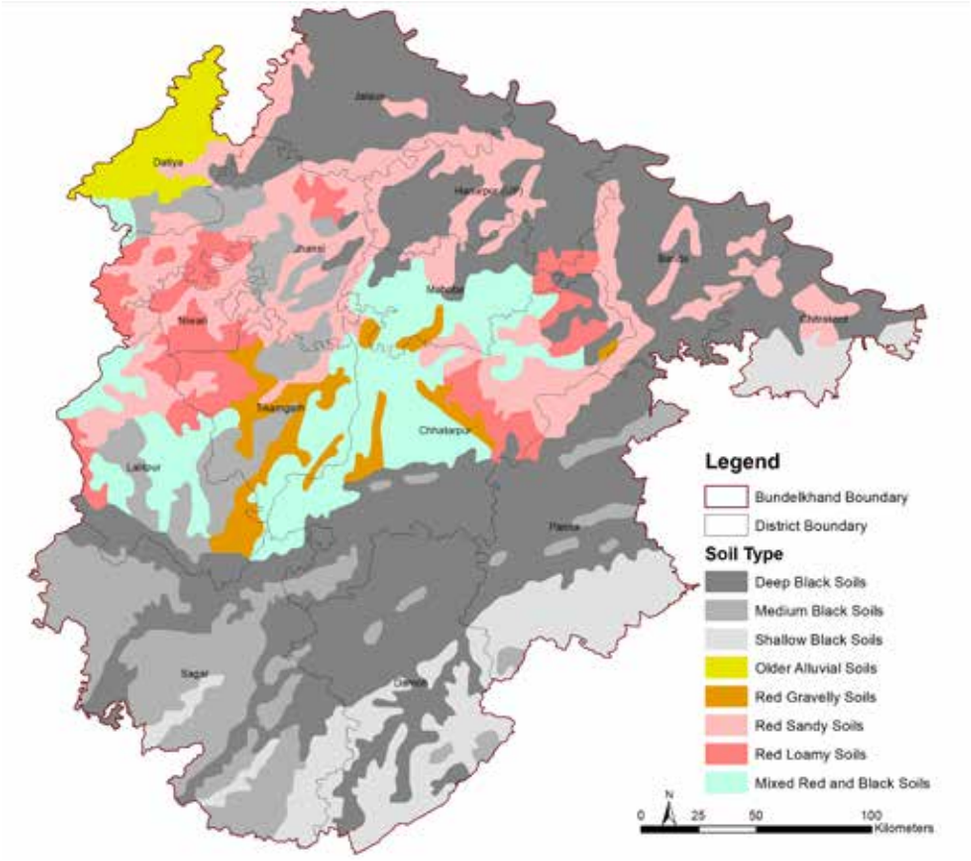
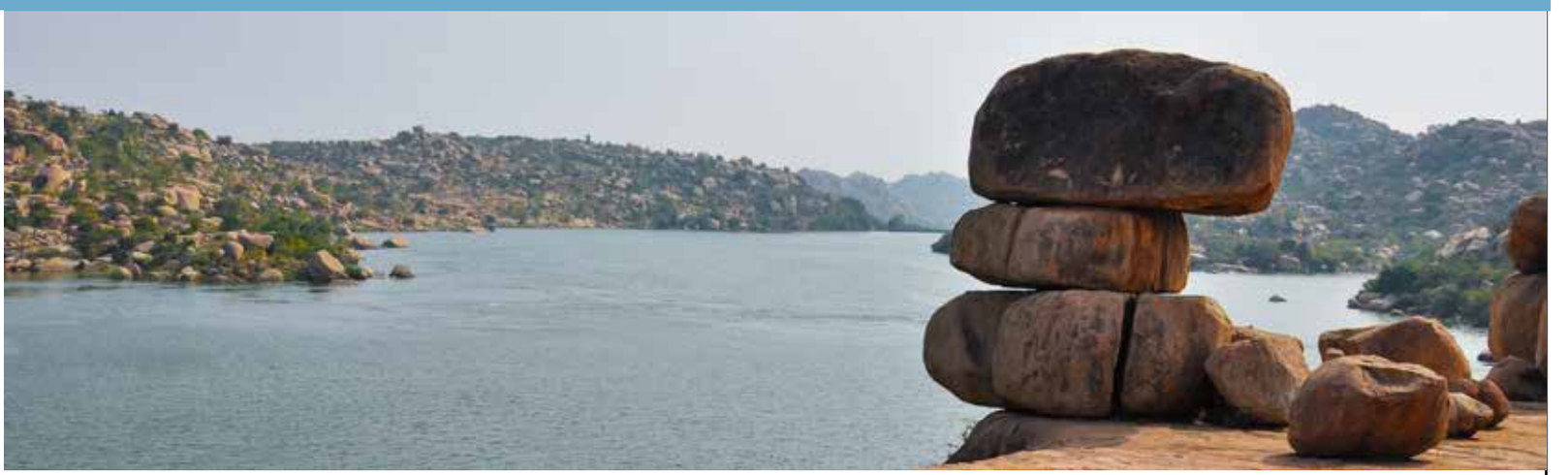


Fig.2.10 The Soil Categories of Bundelkhand Region

3. Approach & Methodology



3.1 Approach

To understand the current situation of the tanks, standalone and network of tanks of various sizes and in multiple setups, This study used technical data and maps and followed a community-driven participatory approach. Throughout the study, its approach was guided by the environmental, socio-economical, management and developmental issues of rejuvenation and conservation of tanks/ network of tanks in the region.

The Blueprint for Rejuvenating Traditional Tanks in Bundelkhand using a participatory approach to tank management underpins the steps shown in Fig 3.1

Fig. 3.1 The Blueprint for Rejuvenating Traditional Tanks in Bundelkhand using Participatory Approach Framework

Preparing Base map

- SOI Toposheet – delineation of watershed boundaries
- Cadastral Maps – overlaying administrative boundaries
- GIS and remote sensing – visual digitization of subject waterbodies and tanks
- Remote sensing and existing thematic maps – delineating of lineament, drainage network, linkages between water bodies and distribution network

Data Collection (Primary and Secondary)

- Generating local geological and geomorphological maps and verification through ground data
- Wells and tanks surveys (covered in case study)
- Consultations with stakeholders about problems and potential pertaining to various parts of cascade
- Downstream catchment area linked water bodies, distribution canals, use of water
- Groundwater and aquifer changes and influence of tank,

Data Analysis

- Generation of the following maps of the catchment:
- Inflow and outflow areas
- Recharge and runoff potential maps
- Submergence and command area
- Groundwater flow directions and recharge area – discharge area delineation

Developing cascade

- Compilation of data and assessment of various components of cascades based on
- Probable list of action agenda related to cascade's technical, environmental, use, O&M, institutional and administrative
- Stakeholder consultations finalization of management plan and blue print for respective cascade/tank
- Define procedure operationalization or inclusion of blue print as management protocol

3.2 Cascade Management Framework

The Blueprint for Rejuvenating Traditional Tanks in Bundelkhand using a participatory approach to tank management follows a two-pronged cascade management process, i.e., at the cascade and tank levels.

3.2.1 The Regional Level Management Planning

Regional-level management planning should include the prioritization of cascade planning and management. The process of prioritization is based on three considerations, viz., (01) terrain characteristics (secondary data and remote sensing analysis used), (02) statistical analysis (primary as well as secondary data sources used), and (03) importance of the tank Figure. 3.2 shows regional-level and cascade-tank-level management planning approaches. Regional planning would help prioritize cascade-tank-level planning.

Fig. 3.2 Cascade Management Planning Approach

3.2.2 Cascade-tank – Infrastructure Management

Ad-hoc management practices in silos by respective institutions are the norm. Despite the need for collective planning and implementation, the intuitions work largely independently. This has led to inadequate management of components of networks of cascade tanks, i.e., catchment area, inflow/outflow channels, linked canals, water allocation, etc. Therefore, there is a need for integrated management of cascade tanks with strong community participation and collective decision-making for the entire cascade. This blueprint underpins a holistic and integrated community-based approach.

Based on learnings from the programme identifies five management components: (01) infrastructure management, (02) institutional management, (03) water-use regulation, (04) scientific management, and (05) legal provision for management and protection—the description for each management component.

01. INFRASTRUCTURE MANAGEMENT AND MAINTENANCE OF TANKS

- The blueprint suggests repairing and maintaining cascade tanks, including desilting and repairing bunds and waste weirs to increase storage and recharge potential.
- Repair and maintain inflow and outflow channels, including regular de-weeding, cleaning and unblocking to ensure unhindered drainage, optimal recharge, flood prevention and command area distribution management.
- It is essential to deal with encroachment around the tanks and channels sensitively. Encroachment removal needs to be carefully planned and implemented through rehabilitation and dialogue.
- Wastewater must be treated using nature-based solutions, like constructed wetlands, DEWATS, bioswale, etc., before being released into the network of tanks/tanks. It would keep a check on the water quality of the tanks.
- The solid waste management system of the surrounding villages/towns be so planned and managed that no waste is dumped in the tank's surroundings or catchment area.
- Delineate core zone and buffer zone based on structure functions, e.g., tank, canal, stream, and identify the community dos and don'ts in each zone.

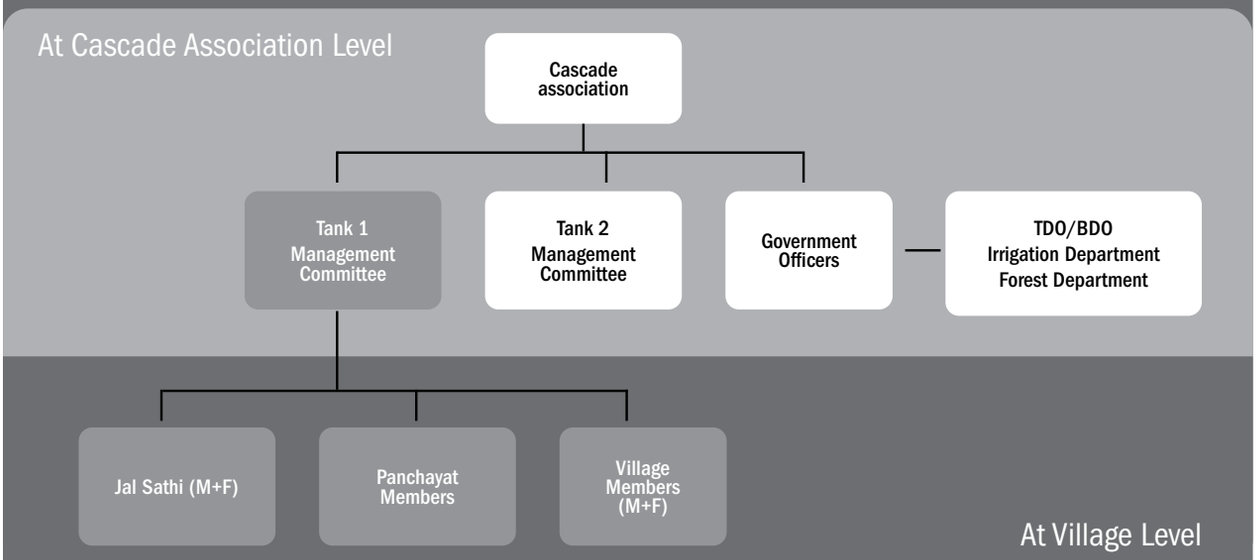
02. INSTITUTIONAL MANAGEMENT AT A VILLAGE LEVEL

For villages in the command and catchment area of tanks

- Tank management committee (TMC): Form a village-level group comprising the panchayat members, local cadre, farming, and non-farming community members in an equal male-female ratio. Representation of elected PRI members can be de-facto. Such a representative group prepares plans for equitable water usage within the village and prepares management protocols for the core and buffer zones of the tanks.
- Membership-based broad-based general body for holding regular meetings and elections.
- Under the Panchayat Act, Gram Panchayats have a provision to constitute such committees. The details of the legal provision are included in the Legal Provision for Management and Protection section.
- Additionally, Gram Panchayat needs to build the management capacities of the Tank Management Committee by developing and implementing various protocols and decision-making tools, e.g., monitoring water balance, assessing and forecasting for decision-making, etc.
- TMC plays an active role in demand management through irrigation water budgeting and ensuring equitable water usage/sharing.
- TMC conducts fortnightly or monthly meetings and records well water level and tank water level.
- TMC (sub-committee as provisioned in the state Panchayats Act) should report to the Panchayat and inform/recommend it on the following:
- Its annual action plan for the tank(s), catchment and cascade components under its jurisdiction.
- Regularly monitor and record water level data in the wells, especially about drinking water requirements.
- The Panchayat's sanction to fine against misuse of drinking water. In cases of monetary fines, TMC must be authorized to collect them.
- Authority to disconnect water supply in case of non-compliance of agreed dos and don'ts.
- Decentralized governance includes the right to levy fees and fines in case of conflicts.
- Twice a year "pre-monsoon and post-monsoon period, TMC must report to the Gram Sabha with the Gram Panchayat sharing the details on changes in groundwater, the status of water resources vis-à-vis drinking water and other domestic and irrigation needs.

Cascade Association

- The Cascade level association can be formed at the cascade level in the case of a network of tanks.
- The association could be formed 2-3 representatives from each Tank Management Committees.
- The association should include officers from the relevant government departments, such as the irrigation department, forest department and respective block and taluka development officers.
- Cascade Association develops the plan for the overall upkeep of tanks and connecting channels within the cascade. This will ensure that each tank is seen in the larger context of its upstream and downstream connections and not in



03 WATER-USE REGULATION

- The tanks and channels linking them in the cascade network recharge groundwater and increase the moisture content of the surrounding farms. Considering this, an irrigation calendar should be made for farmers to increase water use efficiency in irrigation.
- A season-wise assessment of groundwater and surface water availability should be made in each cascade network's command area.
- Water demand calculation for a cascade's command area should be done with all stakeholders. The water balance should be calculated based on seasonal water availability and demand.
- This water balance will help to better plan water usage for human drinking, domestic use, cattle drinking and irrigation, even in the low rainfall years. The plan should be based on conjunctive use of surface and groundwater.
- Crop water budgeting and cropping patterns for the command area must also be prepared.
- To execute the planning, family-level seasonal planning needs to be practised by each committee with the help of the local community cadre.
- Based on water balance, the committee should prepare an advisory for various circumstances like low rainfall, late rainfall, availability of groundwater in shallow zones, etc.
- All these components should be built into capacity-building modules and customised to suit the capacity building of each tank committee.

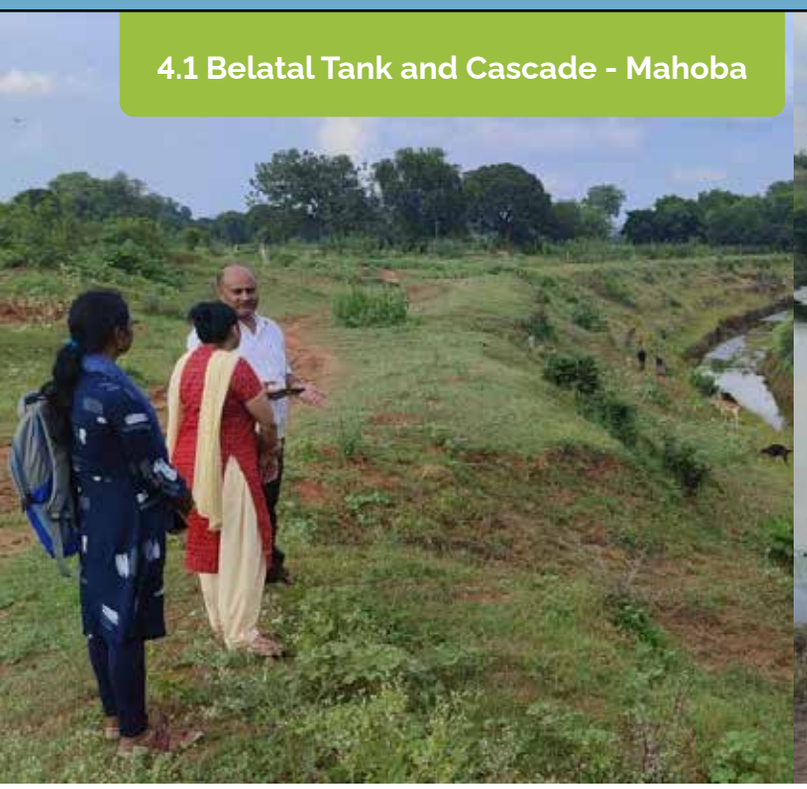
04. SCIENTIFIC MONITORING:

- A regular scientific monitoring of the tanks is necessary. Based on this, cascade tank management plans are prepared, and their long-term good upkeep is ensured. Scientific monitoring of the tanks should include regular data collection of groundwater level and water quality and assessment of available water for use and irrigated cropping area by community cadre. The frequency of different data parameters needs to be decided.
- Record daily rainfall data during the monsoon season.
- Record groundwater level in wells and surrounding tanks within the zone of influence. That can be prepared by drawing groundwater contours by using primary data.
- Measure the water level of tanks and capture its seasonal fluctuation.
- Measure water quality parameters for the tanks and groundwater.
- Monitor the tank and channel infrastructure status and the nature of use and management of the tanks.

Fig. 3.3 Proposed Institutional Structure for Tank Cascade Management

4. Case Studies

4.1 Belatal Tank and Cascade - Mahoba



4.1 The Salient features of Belatal Tank and Cascade - Mahoba

Table 4.1: The Salient Features of Belatal Tank and Cascade

LOCATION	**Village:** Belatal | **Block:** Jetpur | **District:** Mahoba
TYPE	Minor Cascade
CATEGORY	Maximum Density Minimum Irrigation
OBJECTIVE	Integrated management by managing surface and groundwater Interface
LINKAGES WITH OTHER WATER BODIES	**Total No of Water bodies:** 07 upstream (02) and Downstream (05)
	Up Stream: Piparav talav and Ghonchi talav located in village Katara
	Downstream: Krishi vigyan Kendra Pond, Dhau samundar talav, Bora talav, Sitari talav, Harijan basti talav
HYDROLOGY	**Submergence area** – 300 Ha
	Catchment area: 11278 Ha
	Command area: 26169
	Rainfall requires to overflow: 850 MM

USAGES	**Main Tank** • A filtered main tank provides soil moisture benefit in the peripheral area, not less than 1 km in the last Kharif season, and thus helps farmers for Kharif irrigation. • The overflow feeds 05 tanks downstream that nearby farmers use for critical irrigation during the Kharif season. • Direct drinking water supply to 36 villages. **Downstream areas of Belatal Tank** • Groundwater recharge occurs in about a 500 m radius downstream where farmers use shallow groundwater for irrigation in the Kharif and Rabi seasons.ter for irrigation in the Kharif and Rabi seasons. • Some open wells in Belatal village are also used for drinking water supply. **Canal area** • Due to seepage from the unlined canal, about 100 sq m area gets recharge benefits, and people use this water by digging shallow pits (chapra) for various purposes. **Linked Tanks in Downstream areas** • Largely used for critical irrigation during Kharif and Rabi season. • Domestic and cattle drinking water. • Fishing activity during water storage period. • Partial submergence areas are used for agriculture during Rabi or extended Kharif season for some water body submergence areas.
MANAGEMENT	• The irrigation department manages the main tank. • The canal maintenance is done by gram panchayat as per requirement. • Only the Bora tank has a tank protection committee set up by the villagers.

Plate 4.1: Components of Belasagar Tank

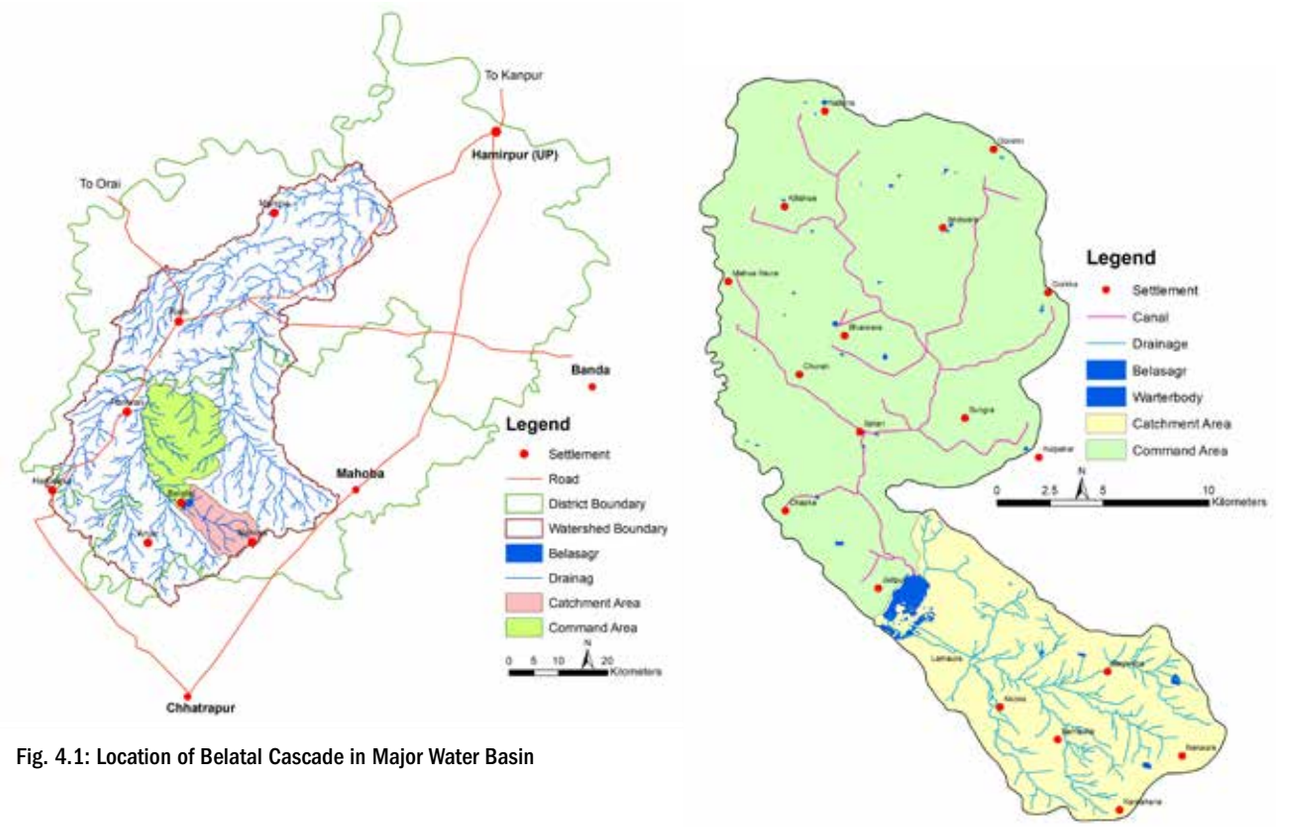


Fig. 4.1: Location of Belatal Cascade in Major Water Basin

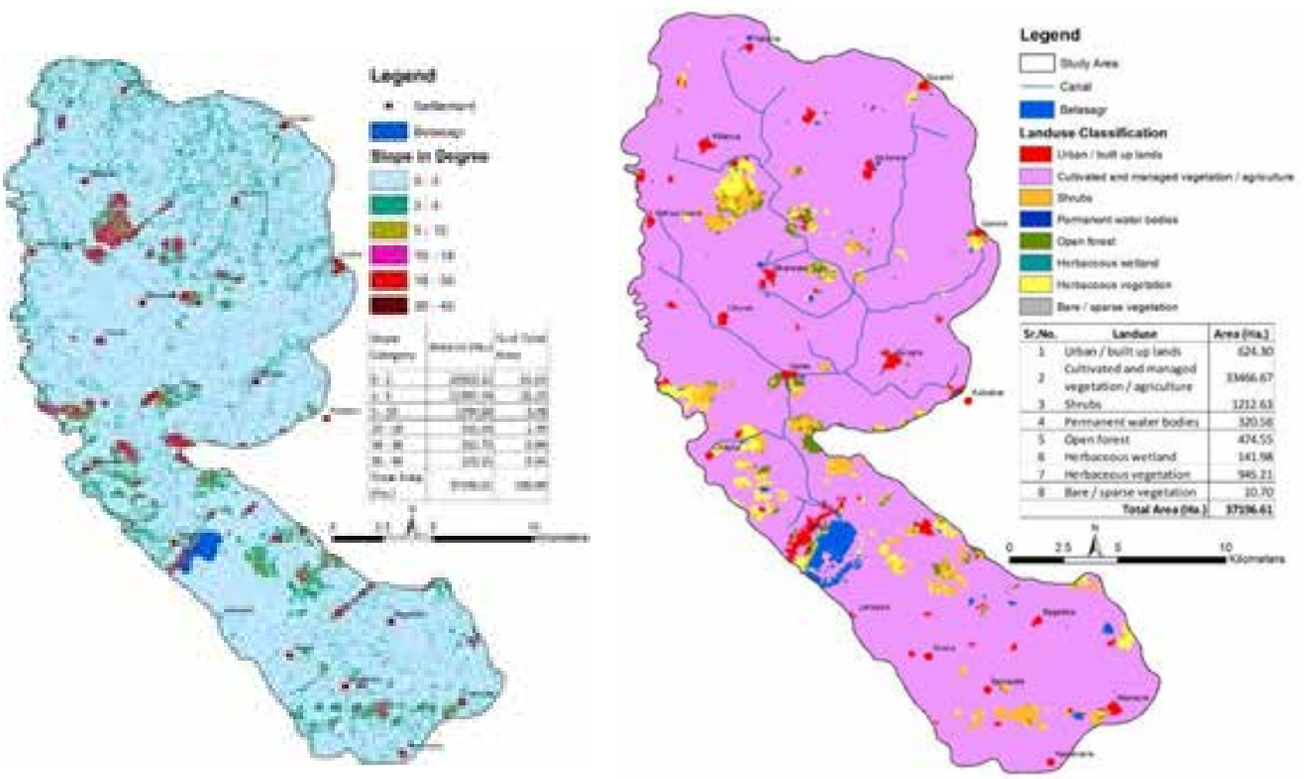


Fig. 4.2 Catchment and Command Area Characteristics of Belatal Cascade (A) Catchment and Command Area Delineation; (B) Slope Aspects and (C) Land use Pattern

Table 4.2: Issues Mapped in Belatal Cascade

LOCATION	ISSUES				MITIGATION PLAN
	INFRASTRUCTURE	OPERATIONAL & MANAGEMENT	RESOURCE DEPENDABILITY	OTHERS	
UPSTREAM AND DOWNSTREAM	Inflow streams have narrowed due to encroachment	Lack of integrated institutional management of the entire cascade. Belatal and Sitri tank management is done by the village Panchayat. Water use is not regulated.	Partial collection of water during low rainfall or reduction in inflow reduces the recharge potential of the surrounding areas.	Road construction in the catchment diverts inflow water to other catchments	Strengthened cascade level associations. Gram Panchayat includes tank management in its GPDP and provisions for budget, regulates water usage and monitors regularly. The Gram Panchayats need to develop maintenance and management protocols for land use, infrastructure planning and development projects for the catchment and command areas.
WATER BODIES	---				
CANAL NETWORK	Unlined with vegetation growth				The canal needs to be lined, and the respective TMCs need to undertake its regular maintenance. The required resources can be allocated under the Participatory Irrigation Management programs like Pradhan Mantri Krishi Sinchayee Yojana (PMKSY) of the Irrigation Department.
DOWNSTREAM AREAS	---				
SUPPLY AREA	---		Shortfall of drinking water in 36 villages after mid-winter		The quantity required for cattle drinking should be estimated, and the amount required should be reserved.

IMPACT

The lack of supervision of the catchment area led to insufficient water storage in the main tank, which had the following effect:

- Shortage of water supply in 36 villages immediately after the monsoon season
- Nearly 3400 cattle were affected by the shortage/non-availability of drinking water.
- Low recharge in a 3.5 sq. km area leads to decreased water availability during summer.

4.2 Arjunsagar Tank and Cascade – Mahoba

Plate 4.2: Arjunsagar Lake

Table 4.3: The Salient Features of Arjunsagar Tank and Cascade

NAME OF CASCADE	ARJUNSAGAR TANK AND CASCADE
LOCATION	**Village:** Sella | **Block:** Charkhari | **District:** Mahoba
TYPE	A Major Cascade
CATEGORY	Maximum Density Minimum Irrigation
OBJECTIVE	Primary water body inter-watershed connections with medium to significant water bodies.
LINKAGES WITH OTHER WATER BODIES	**Total No of Water bodies:** 65 (upstream (63) and Downstream (02)
	Downstream: Lachuara dam with canal
HYDROLOGY	**Submergence area** – 1440 Ha.
	Catchment area: 34620 Ha.
	Command area: 59722 Ha.
	Rainfall requires to overflow: 850 mm.
USAGES	**Main Water Body** • Farmers about 5 km around the tank benefit from good soil moisture during the Kharif season. • The tank is the water source for 02 water bodies located downstream that support critical irrigation during the Kharif season. **Downstream areas of Arjunsagar Dam** • The tank recharges groundwater in about a 5 km radius downstream, where farmers use shallow ground-water for irrigation purposes in the Kharif and Rabi seasons. • It also recharges open wells in nearby villages for drinking water supply. **Canal area** • Canal recharges about 42 km across its length. In this water-recharged area, people dig shallow pits (chapra) for water and meet their various domestic and irrigation water needs. **Linked Tanks in Downstream areas** • Largely used for critical irrigation during Kharif and Rabi season • Domestic and cattle drinking water • Fishing activity during the water storage period • Submergence area above the waterline is used for agriculture during Rabi or extended Kharif season
MANAGEMENT	• The irrigation department manages the main water body. • Canal maintenance is done by the gram panchayat as per requirement.

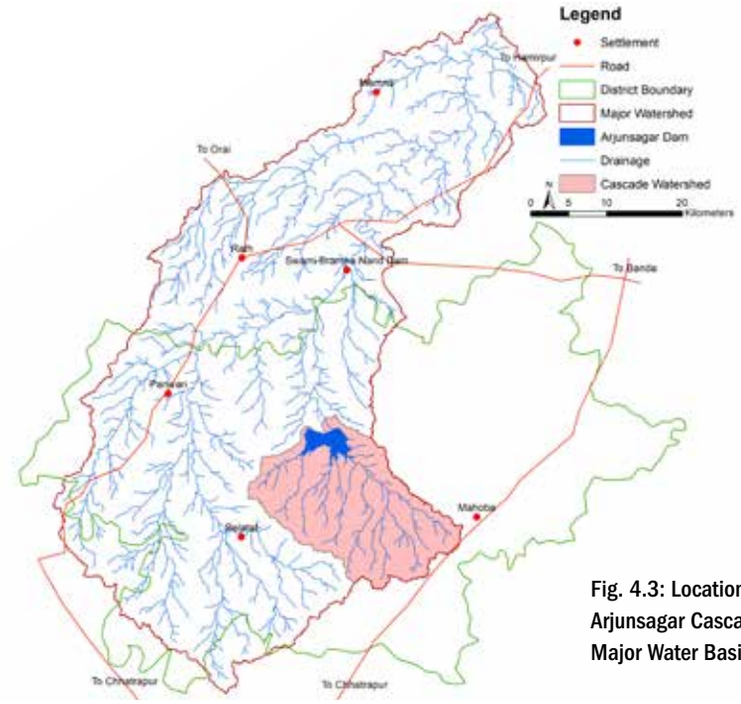


Fig. 4.3: Location of Arjunsagar Cascade in Major Water Basin

Table 4.4: Issues Mapped in Arjunsagar Cascade

LOCATION	ISSUES				MITIGATION PLAN
	INFRASTRUC-TURE	OPERATION & MANAGMENT	RESOURCE DEPENDABILITY	OTHER EXTERNAL	
UPSTREAM AND DOWNSTREAM	Narrowed inflow streams due to encroachment	Lack of integrated management for the tank and entire cascade.	Low rainfall or reduced inflow significantly reduces the recharge potential of areas around the water bodies.	Construction of roads in the catchment diverts water inflow to other catchments.	Cascade Association consists of the Tank Management Committee's representatives and ex-officio members of the irrigation department. For the Catchment and command areas, Gram Panchayats need to develop maintenance and management protocols for land use and infrastructure planning and development projects.
WATER BODIES	Siltation in downstream areas of the tank and cascade	There is a lot of resentment among the people for non-payment of rehabilitation and financial compensation to the farmers whose lands are submerged.			
CANAL NETWORK	Unlined canal and vegetation growth in the pathway				Water inflow and recharge can be improved with the proper lining of the canal network and regular maintenance by the respective TMCs. Resources for this can be allocated under the Irrigation Department's Participatory Irrigation Management-related programs like (PMKSY).
DOWNSTREAM AREAS	---				
SUPPLY AREA	---				

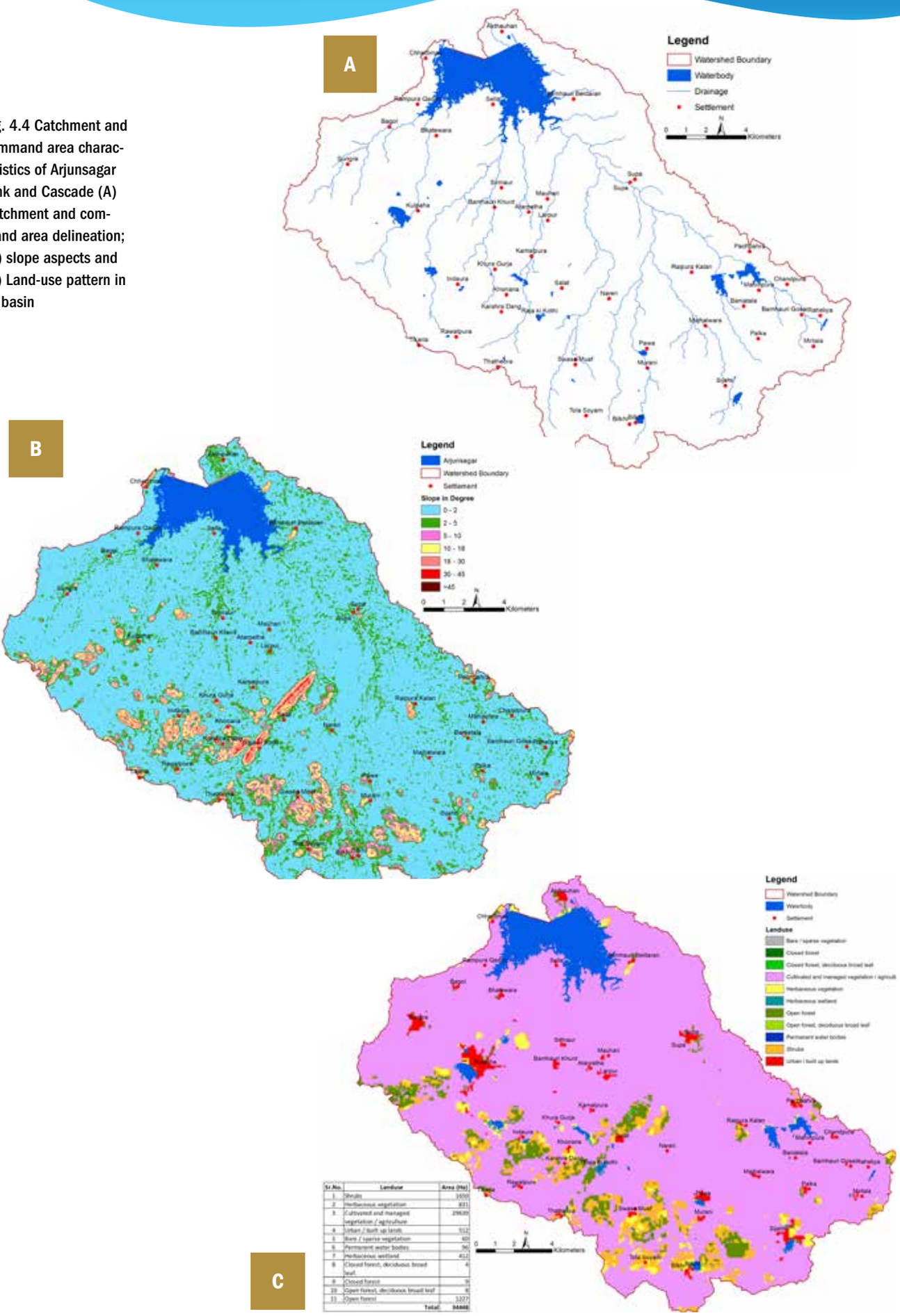


Fig. 4.4 Catchment and command area characteristics of Arjunsagar Tank and Cascade (A) Catchment and command area delineation; (B) slope aspects and (C) Land-use pattern in its basin

4.3 Chhota-Bada Talab and Cascade - Niwari

Plate 4.3: Components of the Chhota-Bada Talab (Tank)

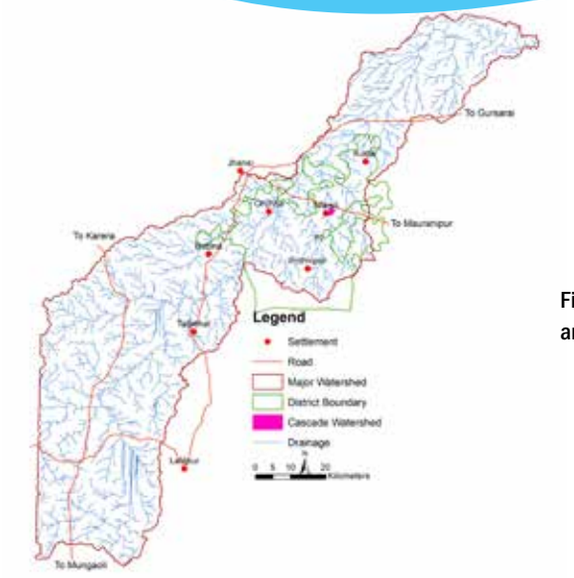


Fig. 4.5 Location of Chhota-Bada Talab and the cascade in their basin

Plate 4.3: Components of the Chhota-Bada Talab (Tank)

NAME OF CASCADE	CHHOTA BADA TALAB AND ITS CASCADE
LOCATION	**Village:** Niwari | **Block:** Niwari | **District:** Niwari
TYPE	Minor Cascade
CATEGORY	Maximum Density Minimum Irrigation (1400 years old system)
OBJECTIVE	Integrated management by managing surface and groundwater Interface
LINKAGES WITH OTHER WATER BODIES	**Total Water bodies:** 02 (Chhota Talab, and Bada Talab)
HYDROLOGY	**Submergence area** – Chhota Talab 6.54 Ha & Bada Talab 54.21 Ha
	Catchment area: 300 Ha
	Command area: 600 Ha
	Rainfall requires to overflow: 850 mm
USAGES	**Main Water Body** • The primary use of the talab or tank is recharging the surrounding bore wells.Help to fill 1 water body in its downstream, that is used by surrounding area farmers for critical irrigation during Kharif season • Fills one tank downstream that provides. Critical irrigation during the Kharif season. • Based on this, the Niwari Municipality has developed a water supply scheme and installed some hand pumps for domestic use. **Downstream areas of Chhota Talab** • The stored water in the tank significantly influences groundwater recharge, extending approximately 3 km downstream in the NW direction, 1.5 km upstream in the SE direction, 4 km in the NE direction, and 0.5 km in the SE. • Recharges private borewells used for drinking water supply in nearby residential areas. **Downstream areas of Bada Talab** • Recharges groundwater in about a 4 km radius in the downstream area in the north, 6 km upstream in the South, and 0.5 km in the east and west sides, where farmers use shallow groundwater for irrigation purposes in Kharif and Rabi season. **Linked Tanks in Downstream areas** • Largely used for critical irrigation during Kharif and Rabi seasonDomestic and cattle drinking water • Domestic and cattle drinking water. • Fishing activity during the water storage period • The submergence area above the waterline is used for agriculture during Rabi or extended Kharif season
MANAGEMENT	• The municipality manages both tanks

Plate 4.4: Various Components of Chhota Bada Talab

Table 4.6: Issues Mapped in Chhota Bada Talab Cascade

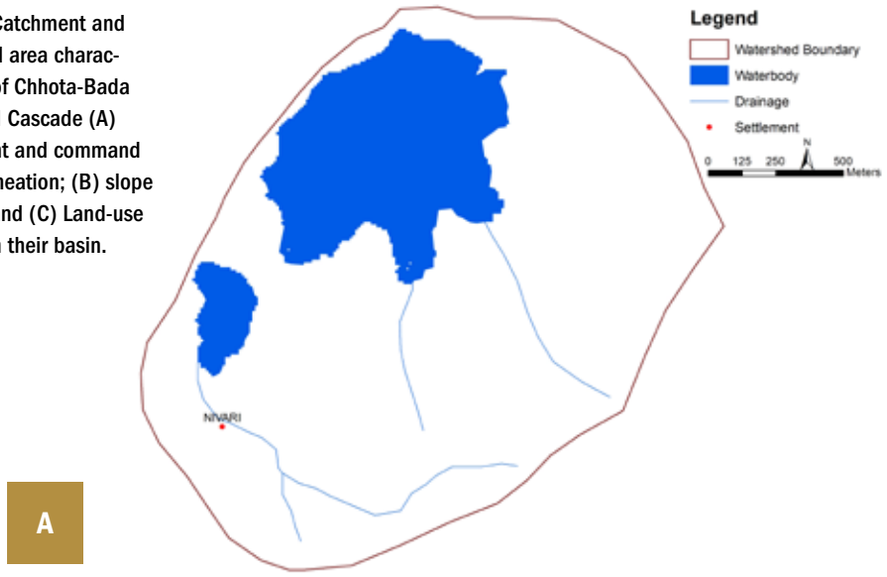
LOCATION	ISSUES				MITIGATION PLAN
	INFRASTRUCTURE	OPERATIONAL & MGMT.	RESOURCE DEPENDABILITY	OTHER EXTERNAL	
UPSTREAM AND DOWNSTREAM	· Narrowed inflow of channels as a result of encroachment. · Irrigation canals are blocked in some places by housing construction	A lack of integrated management of the institutions	The mixing of sewage water in the tank pollutes the groundwater, which impacts wells and borewells, so it can't be used for drinking.	Construction work in the catchment, including road construction, diverts inflow water to other catchments.	Rehabilitate people to vacate encroached areas.
WATER BODIES	The tank dam is broken in some places. ---------- Siltation			Solid waste and sewage pollution	· Regular de-siltation of the tanks · Set up wastewater treatment plant · Repair embankments · Repair Head regulator
CANAL NETWORK	Narrowing and blockage of irrigation canals affect irrigation efficiency.				· Remove blockages in inflow and irrigation channels. · Ensure seepage-free canal lining
DOWNSTREAM AREAS	The waste weir is damaged.				Repair waste weir
SUPPLY AREA	---		Drinking water from the Betwa River is being planned by the municipality.		

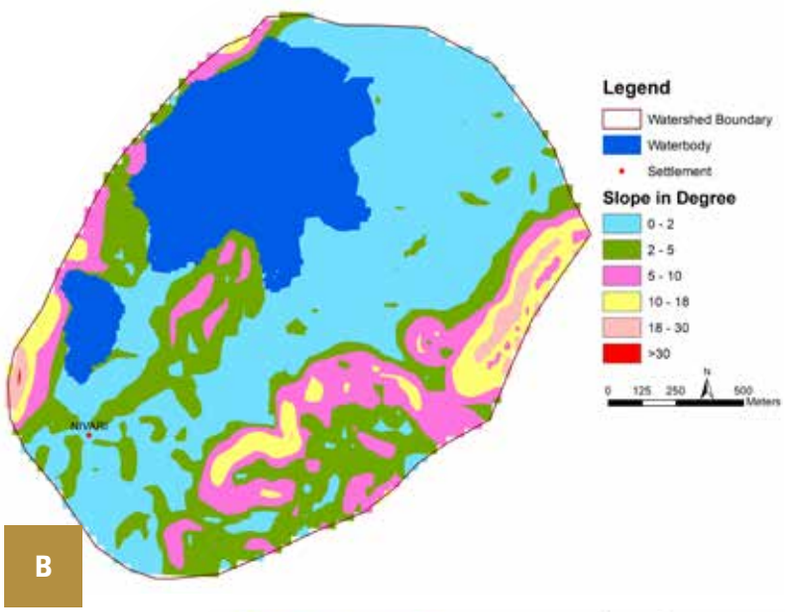
IMPACT

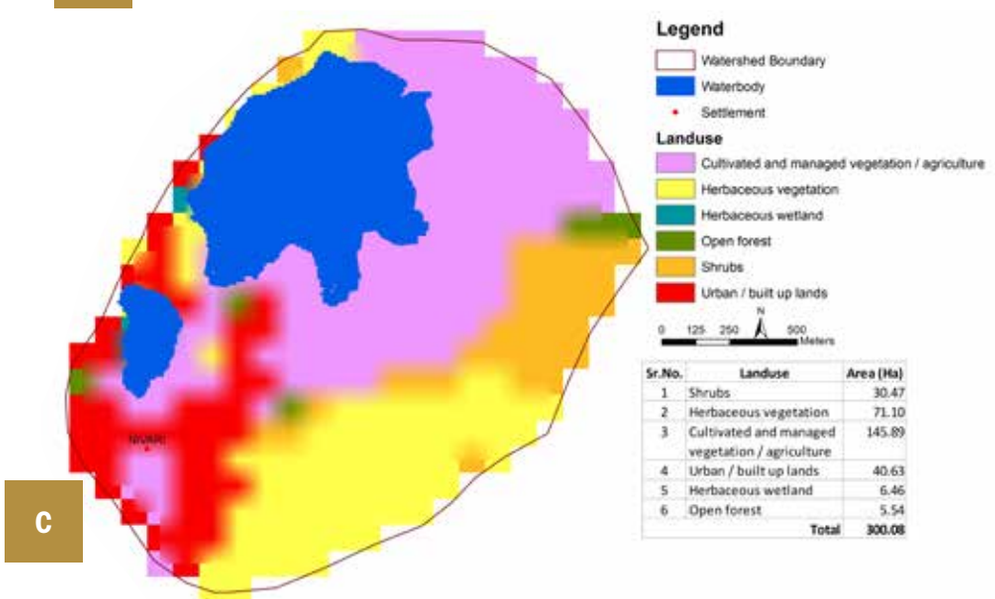
Pollution in tanks affects the following:

- Pollutes drinking water for humans and livestock
- Consumption of polluted water affects health
- Polluted tank water also pollutes groundwater
- Polluted tank water disturbs the tank ecosystem
- Pollution heightens water crisis and dependence on external sources for drinking water

Fig. 4.6 Catchment and command area characteristics of Chhota-Bada Talab and Cascade (A) catchment and command area delineation; (B) slope aspects and (C) Land-use pattern in their basin.







Sr.No.	Landuse	Area (Ha)
1	Shrubs	30.47
2	Herbaceous vegetation	71.10
3	Cultivated and managed vegetation / agriculture	145.89
4	Urban / built up lands	40.63
5	Herbaceous wetland	6.46
6	Open forest	5.54
	Total	300.08

4.4 Arjar Lake Cascade - Niwari

Fig. 4.7 Location of Arjar Lake and Cascade in its Water Basin

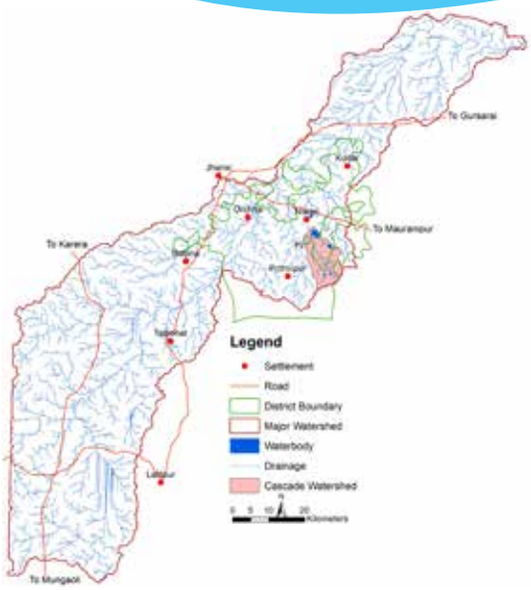


Fig. 4.7: Location of Arjar Lake Cascade in Major Water Basin

Table 4.7: The Salient Features of Arjar Tank and Cascade

LOCATION	**Village:** Astari | **Block:** Niwari | **District:** Niwari
TYPE	Minor Cascade Tank
CATEGORY	Maximum Density Minimum Irrigation (1000 Years old)
OBJECTIVE	Integrated management by managing surface and groundwater Interface
LINKAGES WITH OTHER WATER BODIES	**Total Water bodies:** (06) Sequentially linked with the Sorkha tank, Astari tank, Raipura tank, Magarpura tank, Arjar tank, Barua Sagar Dam, and finally discharges into Betwa River.
HYDROLOGY	**Submergence area** – 312 Ha
	Catchment area: 11270 Ha
	Command area: 2000 Ha
	Rainfall required for overflow: 850 MM
USAGES	**Main Water Body** • Fully filled tank develops required moisture regime up to 3 km in its peripheral area, providing irrigation for Kharif crops. • The overflow of the Astari tank fills four tanks. The overflow of each tank fills the next connected down-stream tank immediately. (Raipura, Magarpura, Arjar (Arjar tank is also called Lochhman pura lake), and Baruasagar). • There is a well in the Astari tank, which 800 families use for drinking water. **Downstream areas of Astari Tank** • Water in the Astari tank recharges groundwater in its 3 km radius downstream, up to 0.5 km. Upstream, and up to an average of 2 km wide strips on the tank's right- and left-hand side where farmers use shal-low groundwater for irrigation in Kharif and Rabi seasons. **Downstream areas of Arjar Tank** • Filled tank recharges groundwater up to 7 km. Downstream, 3 km. Upstream, 2 km. is on the right side of the tank, and 4 km. is on the left side of the tank. Recharged groundwater is used for irrigation during the Kharif and Rabi seasons. **Linked Tanks in Downstream areas** • Largely used for critical irrigation during Kharif and Rabi season • Used as drinking water and for other domestic needs. • Fishing and Shinghada farming activity during the water storage period. • Vacated submergence area is used for agriculture during Rabi or extended Kharif season
MANAGEMENT	• The Gram Panchayat manages the main tank • Villagers in Astari, Raipura, and Arjar tanks form Tank Management Committees.

Plate 4.6: Various Components of Chhota Bada Talab

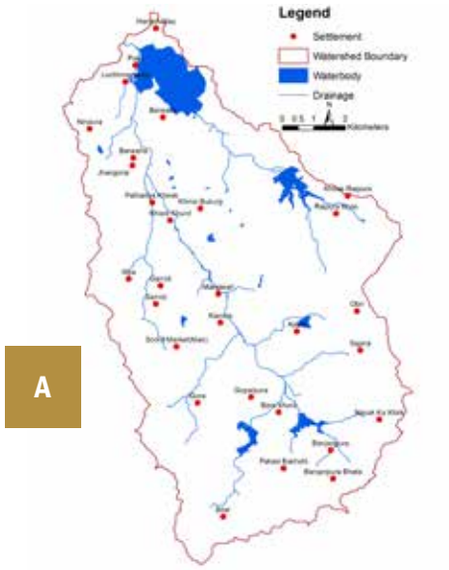
Table 4.8: Issues Mapped in Arjar Lake Cascade

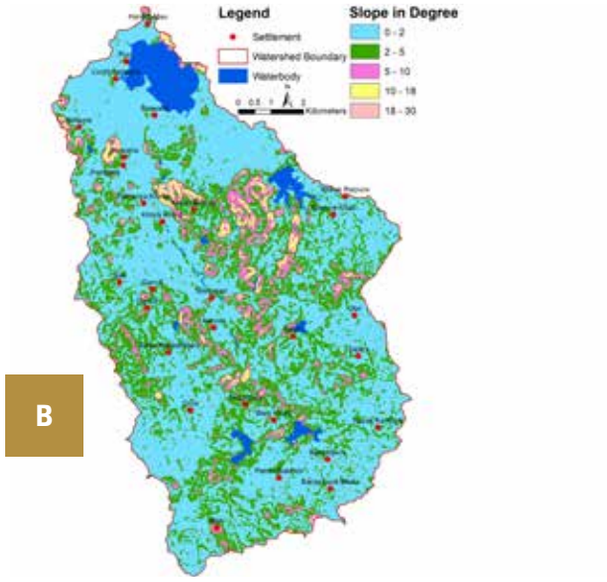
LOCATION	ISSUES				MITIGATION PLAN
	INFRASTRUCTURE	OPERATIONAL & MANAGEMENT	RESOURCE DEPENDABILITY	OTHER EXTERNAL	
UPSTREAM AND DOWNSTREAM	· Due to vegetation growth, water channels have become narrow and blocked in some parts · Waste weirs are damaged in the Astari, Rajpura and Arjar tanks	Respective TMC manages Astari, Rajpura and Arjar tanks. However, the committees take care of only the tanks and not the entire linked system, i.e., catchment inflow channels and distribution canals. In addition, water allocation needs to be done based on availability, and crops need to be planned accordingly.	Rajpura tank has good recharge potential. It recharges groundwater in the surrounding area. However, all aquifers in the region are shallow and dependent on this tank. Due to this and the use of tank water for irrigation, the tank is emptied by February, leading to a water shortfall.		· Waste weir in Astari, Rajpur, and Arjar tanks need to be repaired · Need to build TMC's capacity for water use based on demand-supply estimation · TMC need to develop protocols for the maintenance of all linked infrastructure, and the exact needs to be approved by the GP/ competent authorities
WATER BODIES	Water in the Raipura tank quickly seeps into the ground.				
CANAL NETWORK	---				
DOWNSTREAM AREAS	---				
SUPPLY AREA	---		Shortfall in Drinking water in Raipur village after mid-winter		

IMPACT

The following are the effects of reduced water in the tank due to broken overflows

- Drinking water shortages in three villages, Astari, Raipura, and Arjar, affect humans and livestock.
- Impact on drinking water in two villages, Astari and Raipura.
- Low groundwater recharge impacts in three sq. km areas, leading to decreased water availability issues during the summer.





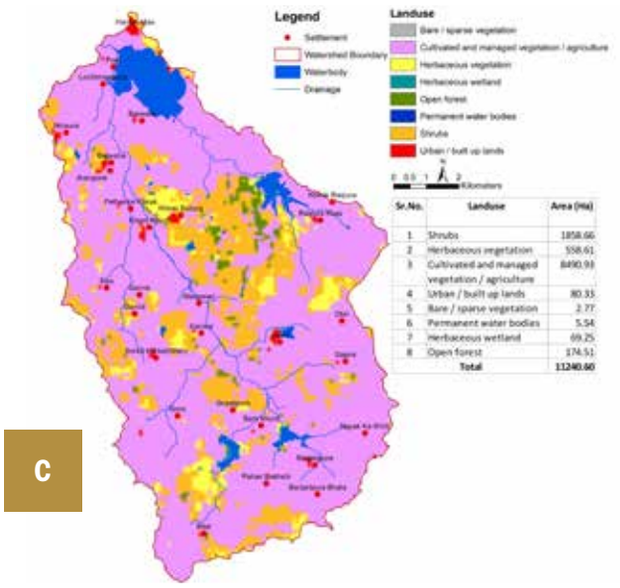


Fig. 4.8 Catchment and command area characteristics of Arjar Tank and Cascade (A) catchment and command area delineation; (B) slope aspects and (C) Land-use pattern in its basin.

4.5 Dharam Sagar Cascade – Tikamgarh

Plate 4.5: Components of stone pitching bund and the link canal from Dharamsagar Tank

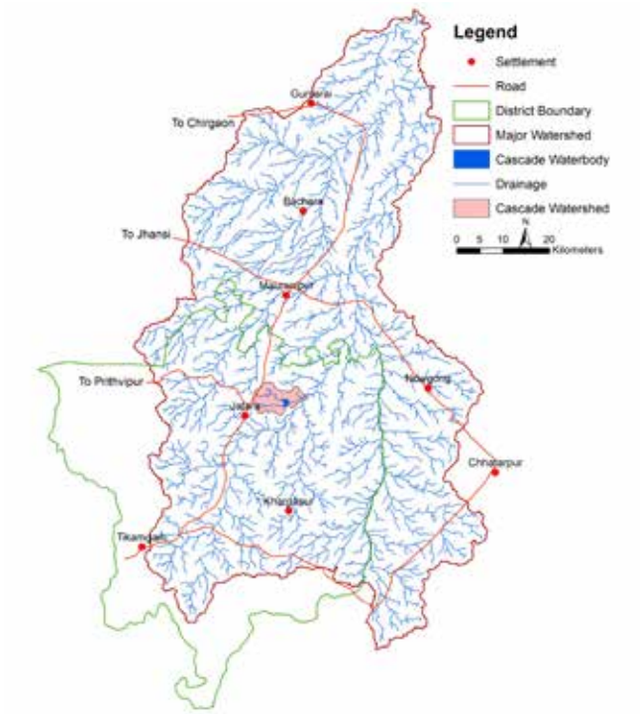


Fig. 4.9 Location of DharamsagarTank and Cascade in its basin

Table 4.9: The Salient Features of Dharamsagar Tank and Cascade

LOCATION	**Village:** Thar | **Block:** Jatara | **District:** Tikamgarh
TYPE	Medium Cascade
CATEGORY	Minimum Density Maximum Irrigation
OBJECTIVE	Cascade network within the medium watershed
LINKAGES WITH OTHER WATER BODIES	**Total Waterbodies:** 10 (upstream (08) and Downstream (02)
	Up Stream: Hini Tank in village Simra Khurd
HYDROLOGY	**Submergence area** – 141 Ha.
	Catchment area: 5055 Ha.
	Rainfall required for overflow: 750 MM
USAGES	**Main Tank** • When the tank is filled, it provides a favourable soil moisture regime for agricultural lands along the 3 km of the tank's peripheral area. It helps farmers in Kharif season irrigation. It helps to fill two downstream tanks nearby farmers use for critical irrigation during the Kharif season. • Provides drinking water supply for 2000 cattle and irrigation of nearby farms of 6000 farmers. **Downstream areas of Dharamsagar Tank** • Groundwater recharge occurs downstream in about a 4 KM radius, where farmers use shallow groundwater for irrigation in the Kharif and Rabi seasons. **Canal area** • Due to seepage from the canal, about 200 m area along its length gets recharge benefits. People dig shallow pits (chapra) for water used for irrigation and domestic purposes. **Linked Tanks in the Downstream areas** • Largely used for critical irrigation during Kharif and Rabi season • Domestic and cattle drinking water
MANAGEMENT	• The irrigation department manages the main tank. • The Gram Panchayat does the canal maintenance

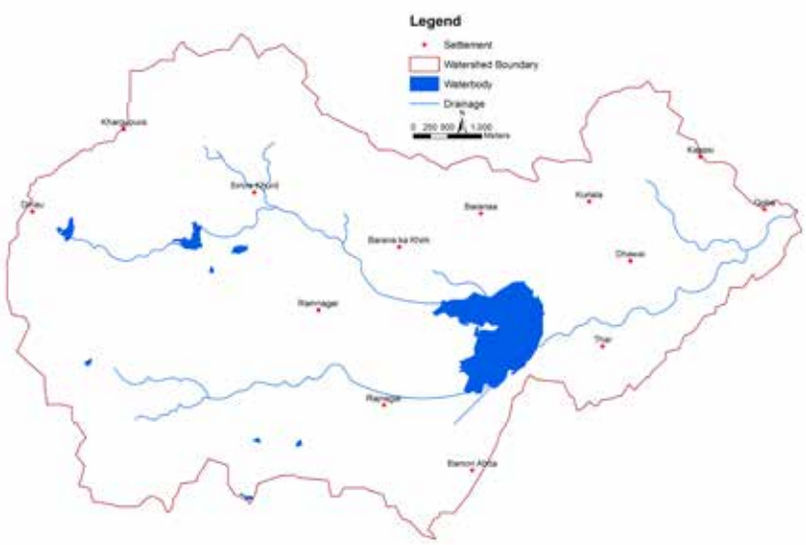
Plate 4.8: Various Components of Chhota Bada Talab

Table 4.10 Issues Mapped to Dharamsagar Tank and Cascade

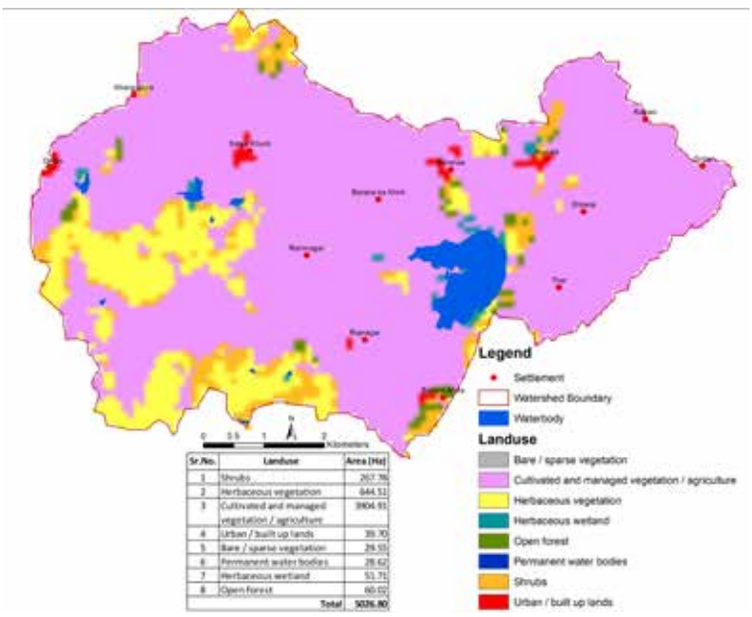
LOCATION	ISSUES				MITIGATION PLAN
	INFRASTRUCTURE	OPERATIONAL & MANAGEMENT	RESOURCE DEPENDABILITY	OTHER EXTERNAL	
UPSTREAM AND DOWNSTREAM	· Vegetation growth has blocked/ narrowed the · Hini Tank upstream of the Dharamsagar Tank	Lack of integrated management institutions for the entire cascade. Hini Tank is managed by gram panchayat. Unorganised water use	Groundwater availability is highly dependent on the water retaining capacity of the Hini Tank, and it dries up quickly due to the rapid groundwater recharge rate. Once this tank begins to dry up, downstream wells, too, dry up. This creates a critical shortfall in the domestic water supply.	NA	· Develop an integrated maintenance and management plan for the inflow channels of the tank. · GP need to set up a tank management committee. · Follow water budgeting by conserving water required for drinking/ non-irrigation purposes. · Introduce water use efficiency practices such as micro irrigation and water-efficient or drought-resistant crop varieties. · De-silt the Hini tank and take measures to slow down water loss to ensure groundwater availability for the lean period
WATER BODIES	Hini tank has significant silt deposition.			NA	
CANAL NETWORK	---			NA	
DOWNSTREAM AREAS	---			NA	
SUPPLY AREA	---		The shortfall in drinking water supply during summers	NA	

Fig. 4.10 Catchment and command area characteristics of Dharamsagar Tank and Cascade (A) catchment and command area delineation; (B) slope aspects and (C) land-use pattern in its basin

A

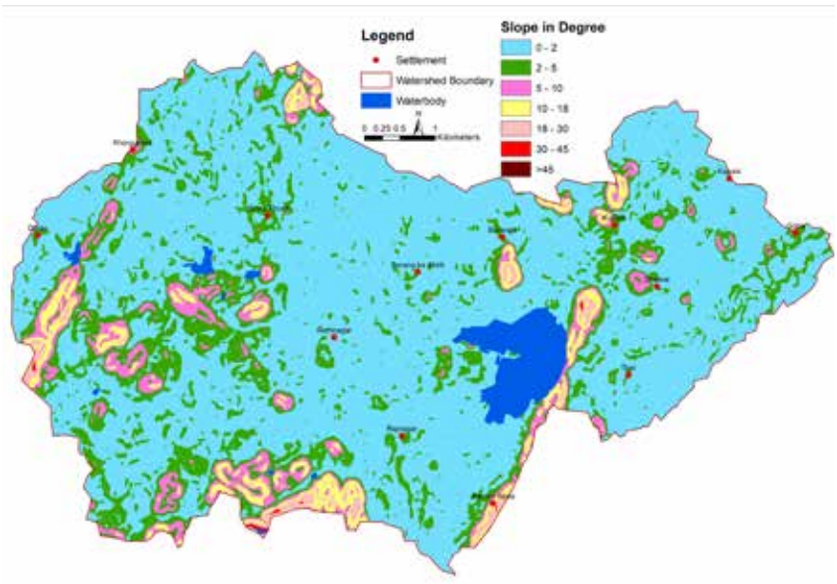


B

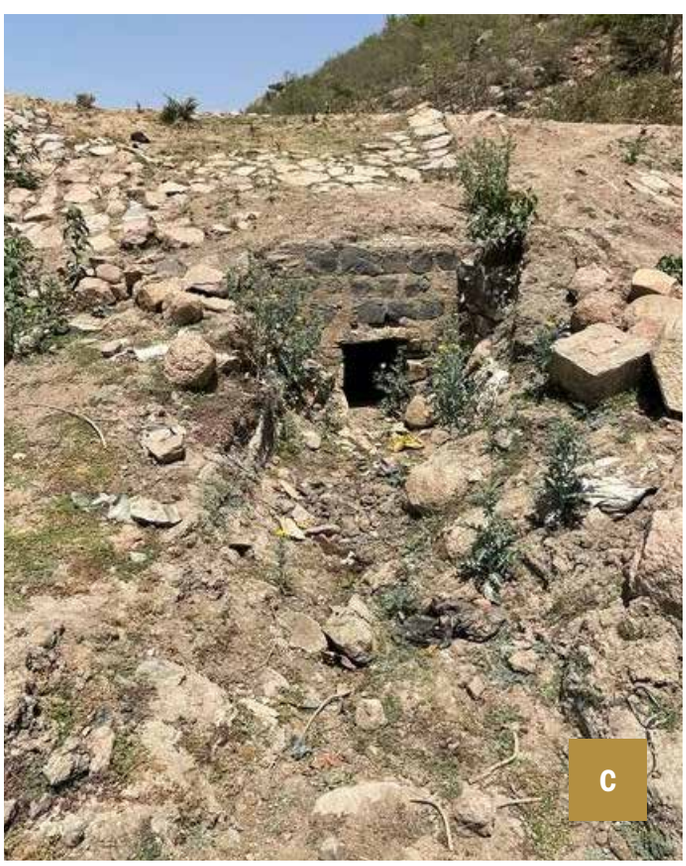


Sr.No.	Landuse	Area (Ha)
1	Shrubs	267.76
2	Herbaceous vegetation	644.51
3	Cultivated and managed vegetation / agriculture	3904.91
4	Urban / built up lands	39.70
5	Bare / sparse vegetation	29.55
6	Permanent water bodies	28.62
7	Herbaceous wetland	51.75
8	Open forest	60.02
	Total	5026.80

C



4.6 Bahora Tank and Cascade – Tikamgarh



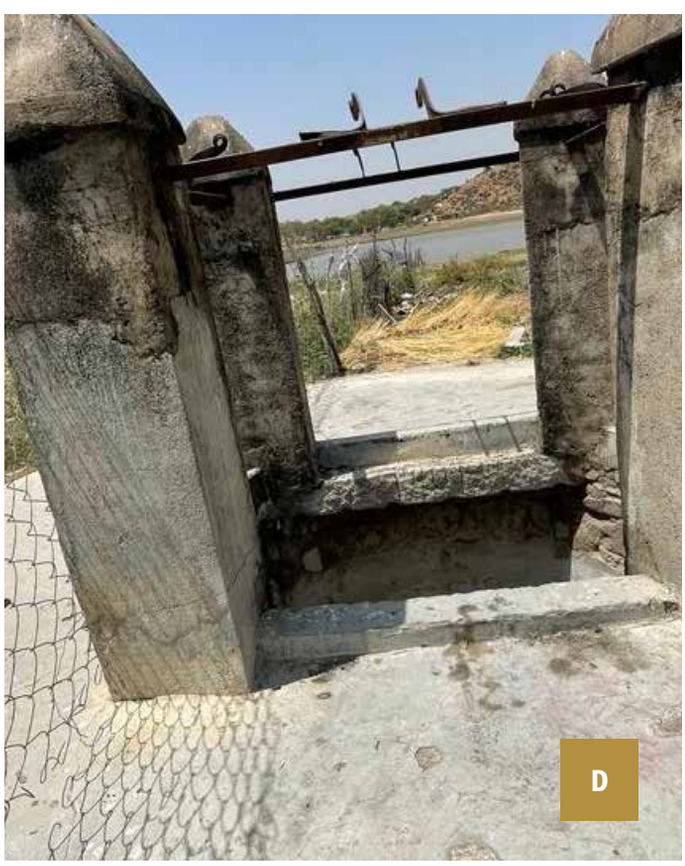


Plate 4.6: Components of (A) Madnasagar Tank (B) Bahora Tank (C) sluice valve of Madansagar Tank and (D) well in Bahora tank

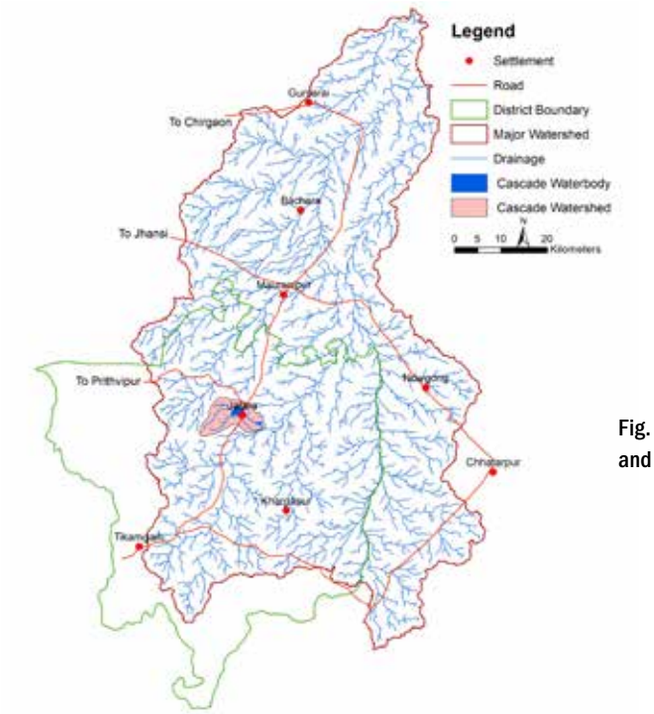


Fig. 4.11 Location of Bahora Tank and Cascade in its basin

Table 4.11: Salient Features of Bahora Pond Cascade

LOCATION	**Village:** Dhabi | **Block:** Jatara | **District:** Tikamgarh
TYPE	Minor Cascade
CATEGORY	Minimum Density Maximum Irrigation
OBJECTIVE	To understand the role of a cascade of Type "Major waterbody inter watersheds. (interlinking of the basin)
LINKAGES WITH OTHER WATER BODIES	**Total Water bodies:** 13 (upstream (11) and Downstream (02)
	Up Stream: Madansagar Tank is located in the village of Jatara.
HYDROLOGY	**Submergence area** – 39 Ha.
	Catchment area: 7347 Ha.
	Rainfall required for overflow: 750 MM
USAGES	**Main Tank** • Groundwater recharge occurs in a very narrow (200 m wide) strip only when the tank has water in its submergence area. The surrounding land area has higher altitude hilly terrain that restricts recharge zones. Because of undulating topography, minimal land is feasible for agricultural purposes, and hence, the tank supports only critical irrigation during the Kharif season only • Helps to fill two tanks downstream that nearby farmers use for critical irrigation during the Kharif season. • Provides drinking water for livestock and irrigation to 375 families of nearby villages. **Downstream areas of Bahora Tank** • Recharges groundwater about 1.5 km downstream, where farmers use shallow groundwater for irrigation in the Kharif and Rabi seasons. **Canal area** • Seepage from the canal provides recharge benefits up to about 100 m along its course. People use this water by digging shallow pits (chapra) for various purposes. **Linked Tanks in the Downstream areas** • Largely used for critical irrigation during Kharif and Rabi season • Meet the everyday water needs of 375 households and their livestock
MANAGEMENT	• The irrigation department manages the Madansagar tank. • The gram panchayat maintains the canal.

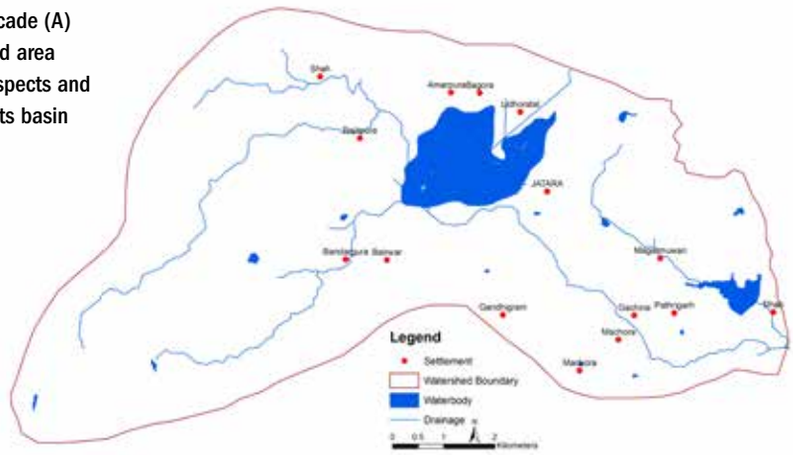
Plate 4.10: Various Components of Chhota Bada Talab

Table 4.12 Issues Mapped to Bahora Tank and Cascade

LOCATION	ISSUES				MITIGATION PLAN
	INFRASTRUCTURE	OPERATIONAL & MANAGEMENT	RESOURCE DEPENDABILITY	OTHER EXTERNAL	
UPSTREAM AND DOWNSTREAM	Vegetation growth has blocked and narrowed inflow water channels of Bahora Tank that is fed by Madansagar Tank located upstream.	Lack of integrated management of the entire cascade. Madansagar Tank management is under the Irrigation Department.	Poor efficiency in rainwater harvesting in Bahora Tank, especially in low rainfall years, severely impacts recharge potential of water bodies including aquifers in the region.	NA	· The irrigation department needs to set up committees, in coordination with the respective GPs, to introduce participatory irrigation management in the catchment and command areas of all linked tanks of the cascade. · Need to prepare integrated maintenance and management plan for all tanks, inflow/outflow channels. · The GPs must set up their respective Tank Management Committee for the day-to-day upkeep and management of the tanks under their charge. · Renovate/replace damaged waste weirs. · Follow water budgeting to ensure drinking water supply year-round for households and livestock. If required, GPs must consider diverting water from a neighbouring micro watershed into the tank and increasing tank's storage capacity
WATER BODIES	Damaged waste weir			NA	
DOWNSTREAM AREAS	---			NA	
SUPPLY AREA	---		Summer shortfall of drinking water for humans as well as livestock	NA	

Fig. 4.12 Catchment and command area characteristics of Bahora Tank and Cascade (A) catchment and command area delineation; (B) slope aspects and (C) land-use pattern in its basin

A



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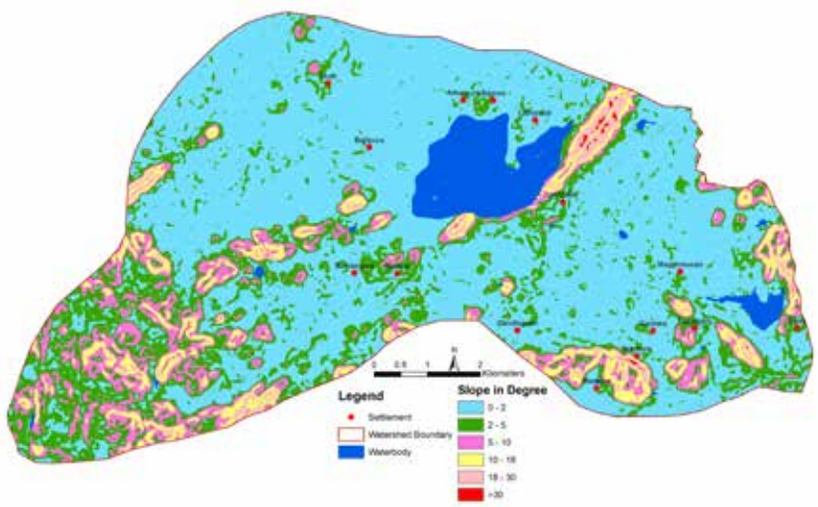

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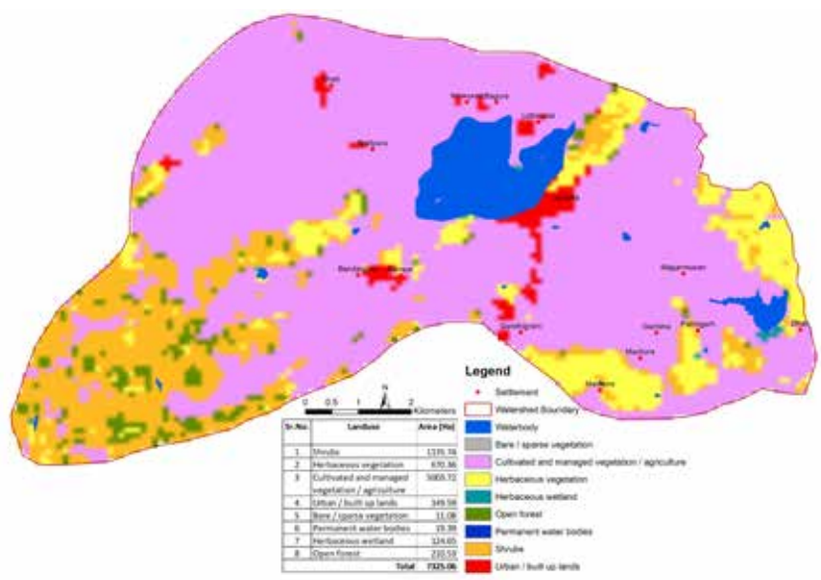


4.7 Barethi Tank and Cascade – Chhatarpur

Plate 4.11: Various Cpmponents of Barethi Cascade

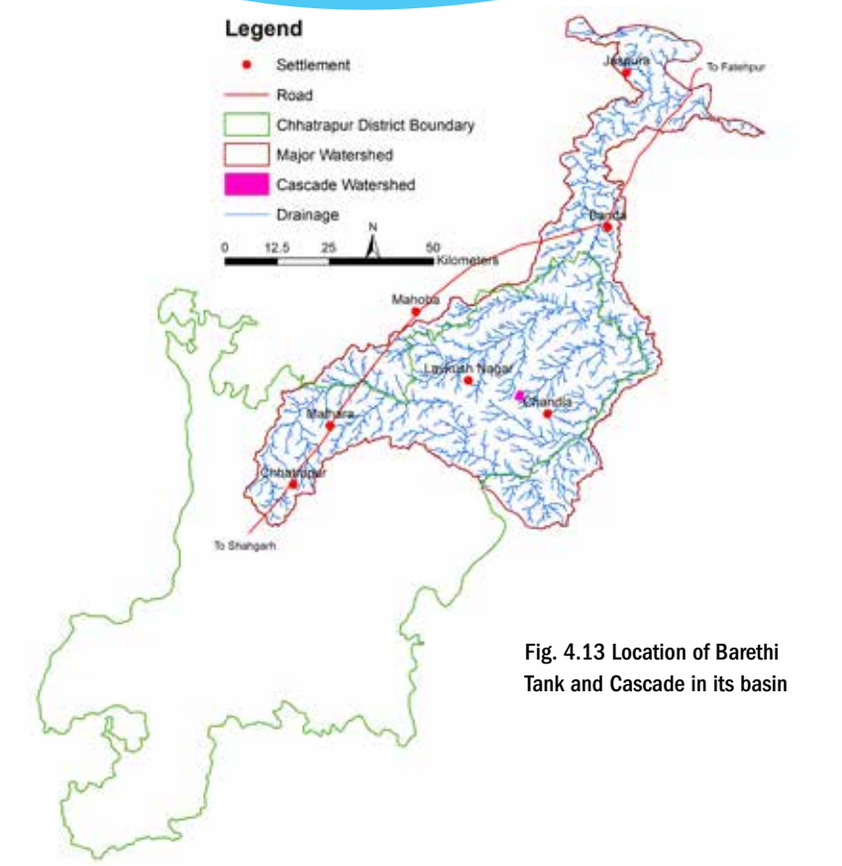


Fig. 4.13 Location of Barethi Tank and Cascade in its basin

Table 4.13: The Salient Features of Barethi Tank and Cascade

LOCATION	**Village:** Jarkala | **Block:** Lauri | **District:** Chhatarpur
TYPE	Minor Cascade
CATEGORY	Maximum Density Maximum Irrigation
OBJECTIVE	Major Water Bodies inter watershed connections with minor water bodies
LINKAGES WITH OTHER WATER BODIES	**Total Water bodies:** 03
	Up Stream: 0 **Downstream:** The tank overflow fills three downstream tanks.
HYDROLOGY	**Submergence area** – 8.3 Ha.
	Catchment area: 435 Ha.
	Rainfall required for overflow: 650 MM
USAGES	**Main Tank** • Even after water in the tank recedes by about 500 m, the peripheral area around the tank has a good moisture content that helps farmers with kharif sowing and irrigation. • Sustains water supply of 03 downstream tanks the farmers use for critical irrigation during the Kharif season. **Downstream areas of of Barethi Tank** • The tank recharges groundwater downstream in about a 500 m radius, where farmers use shallow groundwater for irrigation in the Kharif and Rabi seasons. • Some open wells around Barethi village are also used for drinking water supply. **Linked Tanks in Downstream areas** • Provides critical irrigation during the Kharif and Rabi seasons. • Drinking water for households, livestock, and other domestic needs
MANAGEMENT	• The village Tank Management Committee manages the main tank.

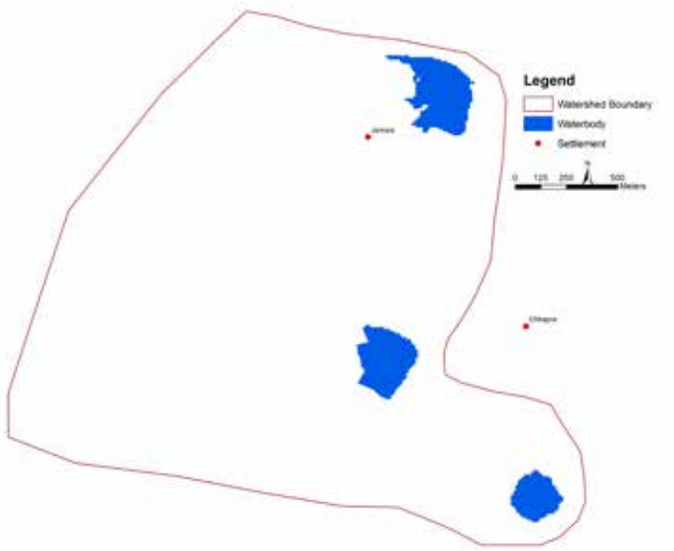
Plate 4.12: Various Components of Chhota Bada Talab

Table 4.14 Issues Mapped in Barethi Pond Cascade

LOCATION	ISSUES				MITIGATION PLAN
	INFRASTRUCTURE	OPERATIONAL & MANAGEMENT	RESOURCE DEPENDABILITY	OTHER EXTERNAL	
UPSTREAM AND DOWNSTREAM	As the catchment area of the tank is agricultural, the water comes in sheet flow, so the quantity of inflow water is less during average rainfall.	Lack of integrated management for the entire cascade. There are no interlinkages between these three tanks.	Insufficient water collection in low rainfall years or reduction in inflow severely affects the recharge potential of the water bodies, including groundwater recharge.	NA	· Catchment Diversion can be explored for proper water inflow management from agricultural lands. · TMCs need to build capacity in water budgeting and water use management. · Tanks need to be desilted from time to time. · Damaged waste weir needs to be repaired/rebuilt. · The embankment needs to be repaired.
WATER BODIES	The embankment of the tank is broken in some places.			NA	
CANAL NETWORK	---				
DOWNSTREAM AREAS	---			NA	
SUPPLY AREA	---			NA	

Fig. 4.14 Catchment and command area characteristics of Barethi Tank and Cascade (A) catchment and command area delineation; (B) slope aspects and (C) land-use pattern in its basin

A



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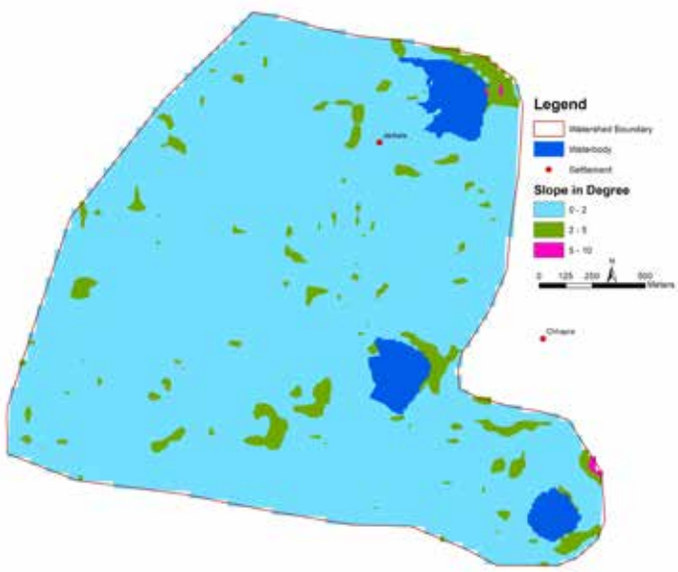

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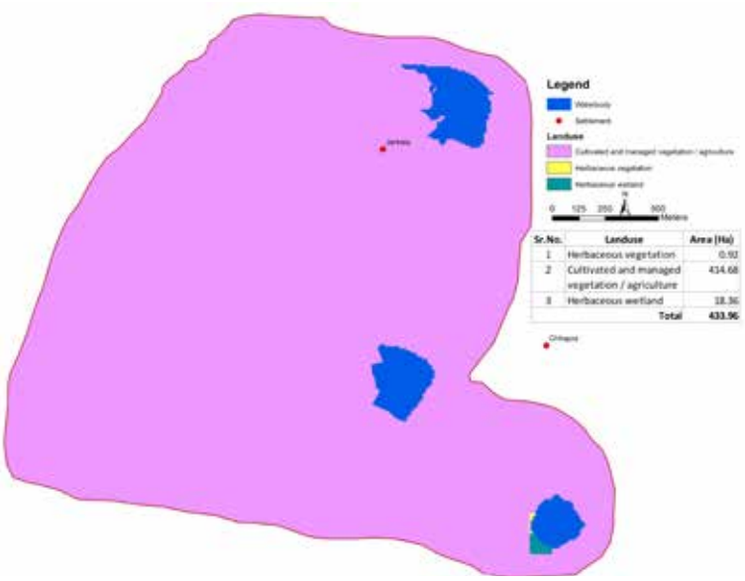


Sr.No.	Landuse	Area (Ha)
1	Herbaceous vegetation	0.92
2	Cultivated and managed vegetation / agriculture	414.68
3	Herbaceous wetland	18.36
	Total	433.96

4.8 Gunta Dam and Cascade – Chitrakoot

Plate 4.8: Components of Gunta Dam and Cascade

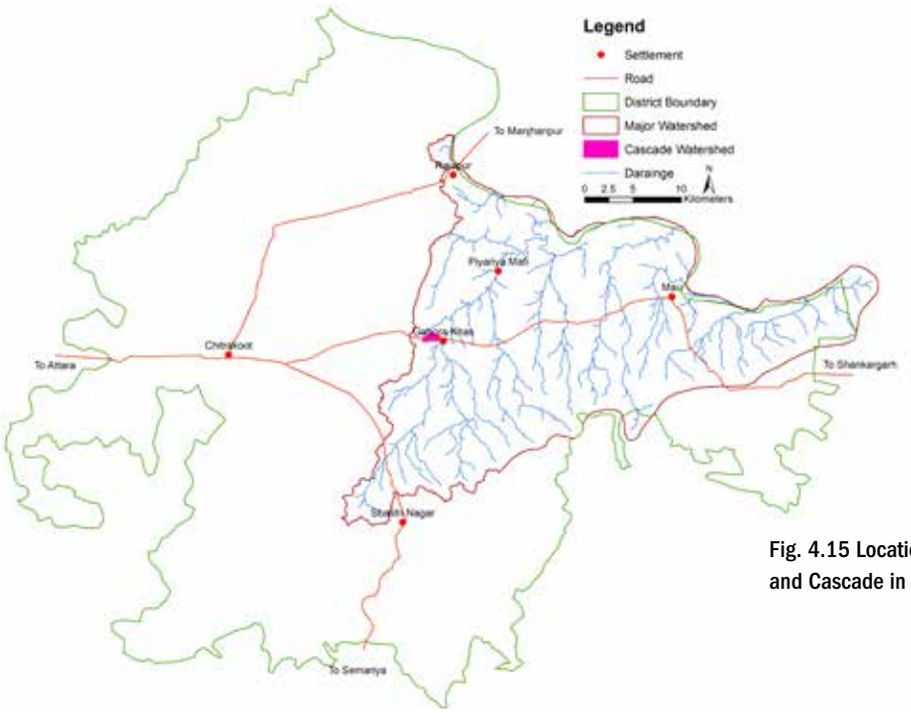


Fig. 4.15 Location of Gunta Dam and Cascade in its Basin

Table 4.15: The Salient Features of Gunta Dam and Cascade

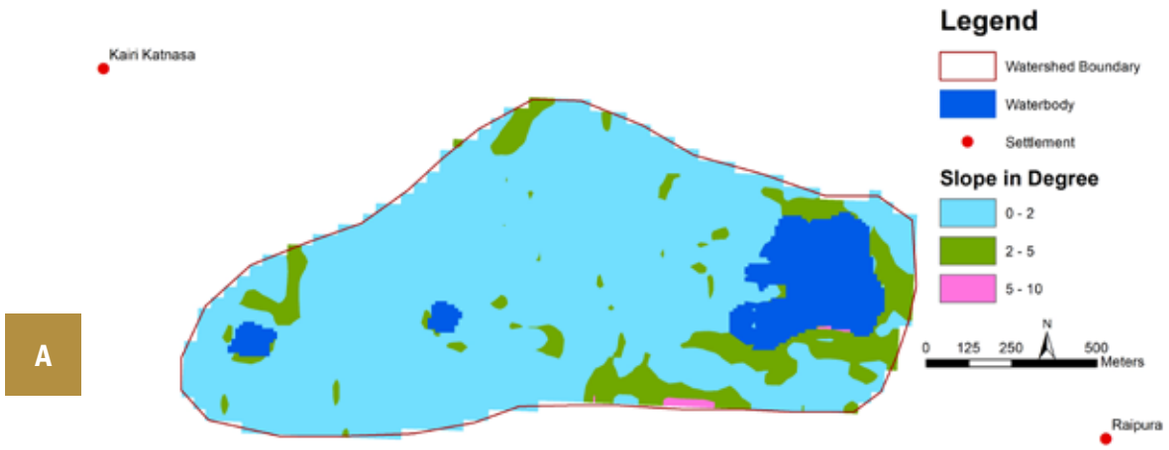
LOCATION	**Village:** Raipura | **Block:** Karwi | **District:** Chitrakut
TYPE	Minor Cascade
CATEGORY	Moderate Density Moderate Irrigation
OBJECTIVE	Primary Waterbody watershed connections with minor water bodies
LINKAGES WITH OTHER WATER BODIES	**Total Water bodies:** 03
	Down Stream: 3 waterbodies located at Gunta Dam
HYDROLOGY	**Submergence area** – 12 Ha.
	Catchment area: 130 Ha.
	Rainfall required for overflow: 850 MM
USAGES	**Main Dam** • About 1.5 km of the area around the dam has good soil moisture and helps the farmer in Kharif irrigation. • The dam overflow fills three downstream tanks the farmers use for critical irrigation during the Kharif season. **Downstream areas** • It recharges groundwater in about a 1 km radius downstream, where farmers use shallow groundwater for irrigation purposes in the Kharif and Rabi seasons. • The tank also recharges open wells in nearby villages for drinking water supply. **Canal area** • A 40 km long canal is connected with this dam. **Linked Tanks in Downstream areas** • Largely used for critical irrigation during Kharif and Rabi seasons. • Domestic and drinking water provision for households and livestock. • Fishing activity during the water storage period. • The peripheral area around the tank has good moisture content and is used for agriculture during the Rabi or extended Kharif season.
MANAGEMENT	• The Irrigation Department manages the main tank. • The Gram Panchayat maintains a canal.

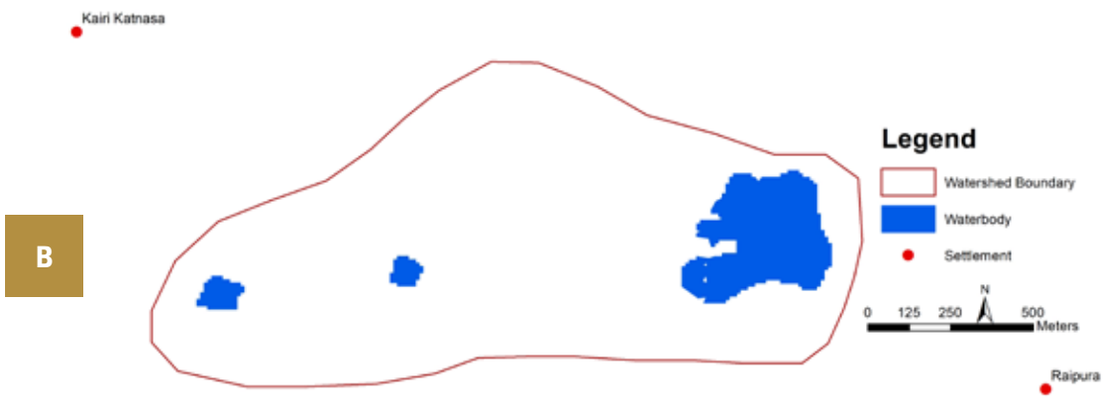
Plate 4.14: Various Components of Chhota Bada Talab

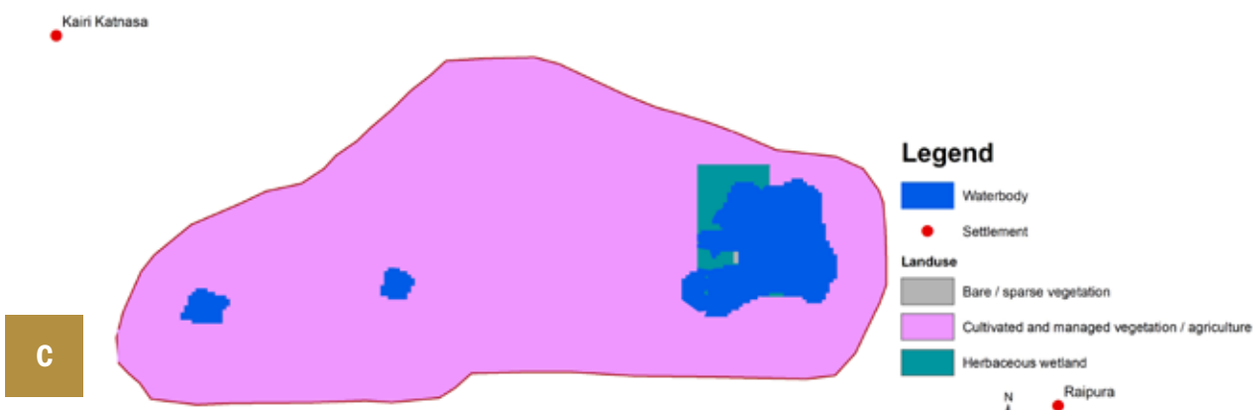
Table 4.16 Issues Mapped to Gunta Dam and Cascade

LOCATION	ISSUES				MITIGATION PLAN
	INFRASTRUCTURE	OPERATIONAL & MANAGEMENT	RESOURCE DEPENDABILITY	OTHER EXTERNAL	
UPSTREAM AND DOWNSTREAM	The catchment area is flat and predominantly agricultural. It generates very low runoff especially, during average rainfall. Does not have built inflow water channels.	Lack of integrated management of the tank and cascades. There are no inter linkages among these three downstream tanks.	Insufficient water collection in the tank from low rainfall or reduced inflow, affects recharge of downstream water bodies including wells.	NA	· Catchment diversion and proper water inflow management from agriculture lands can be explored · Capacity building of TMC in water budgeting and water use can bring several benefits and irrigation efficiencies. · Regular de-silting would ensure efficient capacity utilization. · All tanks need new waste weirs · Embankment needs repairing
WATER BODIES	The embankment of the tank is broken at some places.			NA	
CANAL NETWORK	---				
DOWNSTREAM AREAS	---			NA	
SUPPLY AREA	---			NA	

Fig. 4.16 Catchment and command area characteristics of Gunta dam and cascade (A) Catchment and command area delineation; (B) Slope aspects and (C) land-use pattern in its basin







Sr.No.	Landuse	Area (Ha)
1	Bare / sparse vegetation	1.85
2	Cultivated and managed vegetation / agriculture	115.42
3	Herbaceous wetland	8.31
	Total	**125.57**

5. Analysis & observations

The traditional tanks of Bundelkhand are broadly categorized into two – a) standalone tanks with their own catchment and command area but without linkage with any other waterbody neither on upstream or downstream and b) a network of tanks linked through canals/inflow-outflow channels and referred to in this study as cascades of tanks. This blueprint focuses on the linked tanks in different geohydrological typologies of the Bundelkhand region. Overall, the analysis reveals their sub-optimal utilization for the following reasons:

Catchment and Tank Infrastructure Level Problems

- Vegetation growth in inflow channels obstructs inflows in the main tank and restricts storage.
- Damaged waste weirs lead to water leakage.
- Tanks in urban areas are polluted from, disposal of sewage and solid waste dumps creates water quality issues.

Water Use and Distribution

- By and large, water use in the region is unorganized. Even where a Tank Management Committee (TMC) exists, their jurisdiction is only single water bodies not necessarily covering the entire cascade.
- In case of a major cascade of tanks, the main tank is managed by the Irrigation department. These are often relatively better maintained.

Management and Institutional Issues

- In most cases local level tanks and canals are being maintained by Gram Panchayat based on requirement and available resources. However, there is no plan or strategy for integrated maintenance of the entire cascade of tanks, i.e., including inflow/outflow channels, main reservoir, command area and water use and distribution.
- There is a lack of coordination between the irrigation department, tank management committees and the respective Gram Panchayats or Municipality in the case of urban areas.
- Often, in urban areas, solid waste and sewage are disposed of in and around these tanks, though some municipalities have taken the corrective measure of setting up sewage treatment plants.
- Several major tanks in the network of linked tanks are regulated by the Irrigation Department and minor linked tanks by the Gram Panchayats or, in some cases, by the Tank Management Committees without the required coordination among the stakeholders.

Table 5.1 Category and Cascade wise Summary of Key Problems

MAIN CATEGORY	SUB CATEGORY	TANK	KEY PROBLEMS
MAX. DENSITY MAX. IRRIGATION	Minor Cascade – Rural	Barethi	Rainfall-dependent small catchment Inadequate catchment management has affected water in-flow and storage
MAX. DENSITY MIN. IRRIGATION	Minor Cascade-Rural	Belatal	Inadequate catchment management. Unregulated water usage. Shortfall of water during summers.
	Major Cascade-Rural	Arjunsagar	The irrigation department regulates the main tank, a minor water body linked by Gram Panchayat. Lack of coordination between different institutions.
	Minor Cascade-Urban	Chhota-Bada Talab	Urbanization and pollution issues. Clogging of channels. Inadequate management of infrastructure
	Minor Cascade-Rural	Arajar	Unregulated water use distribution. Shortfall of water during summers.
MIN. DENSITY MAX. IRRIGATION	Medium Cascade-Rural	Dharamsagar	The Irrigation Department manages the main tank, and Gram Panchayats manage minor linked tanks. Inadequate response for repair-based requirements. Damaged infrastructure.
	Minor Cascade-Rural	Bahora	Vegetation growth in inflow channels. Damaged infrastructure. Sub-optimal potential utilisation.
MED. DENSITY MED. IRRIGATION	Minor Cascade – Rural	Gunta	Rainfall dependent and small catchment. Inadequate management of the catchment area reduces water inflows. Damaged and improperly managed infrastructure. No proper waste weirs.

6. Holistic Approach to Stabilising Agriculture and Rejuvenation of Traditional Tanks

Rejuvenation is more than restoration. While restoration is a short-term return to the status, rejuvenation calls for action to sustain ecosystem health to help it function well. For tanks, restoration implies de-siltation. For traditional tanks, rejuvenation requires an all-round sustainable management —well catchment and channel management, regular upkeep, and regulated use. This chapter examines how tank rejuvenation can impact farmlands.

The tank rejuvenation work by SRIJAN has addressed the critical challenges of water, agriculture, and livelihoods in Bundelkhand. This involved community action collectively addressing the challenges through community institutions and dedicated water champions. These institutions learn and promote climate-smart agriculture, alternate farm-based livelihoods and water-efficient crop management (Fig 6.1).

Fig 6.1 Rejuvenated Tanks and Sustainable agriculture in Bundelkhand Program

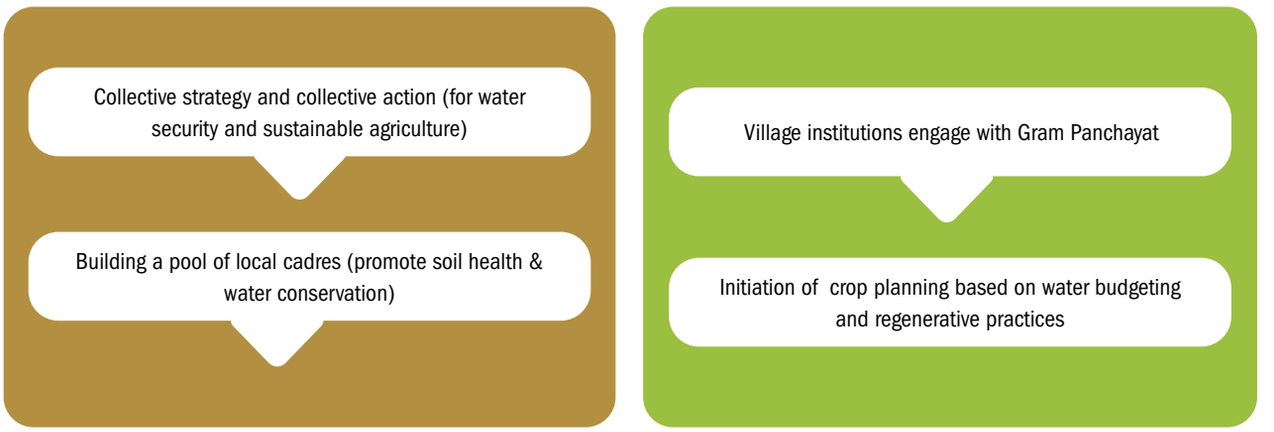
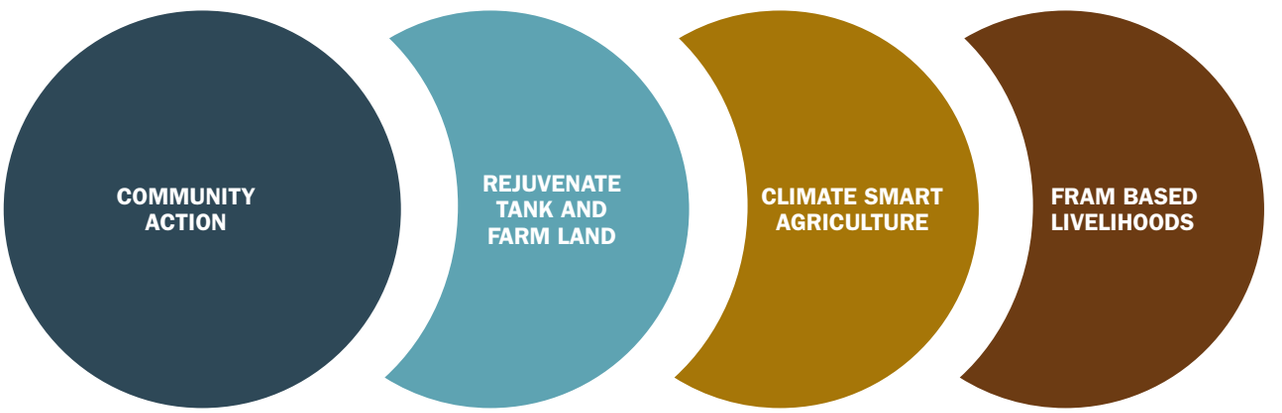


Fig. 6.2: Holistic Program Strategy



- Collective action
- Capacity building of TMC member
- Liaising with local gram panchayat

- Tank de-siltation
- Silt use in farmland
- TMC formation

- Bio-resource Centre
- Seed Banks, agri-tools
- Knowledge extension

- Multi-layer farming (3-5 vegetables)
- Fruit orchards
- TMCs linked to Farmer Producer Organisation

Step 1: Effective Tank Management Committee

Beneficiary villages constitute the Tank Management Committee (TMC). Depending upon the tank command area, a TMC general body may consist of 100-150 households. Among the beneficiary households, 10-15 members are selected as Executive Committee members. These members meet regularly to monitor, plan and act on water security and climate-resilient agriculture. Local governments back the TMCs. Women have been their key drivers. With support from the program staff and water champions, the TMCs have brought about the transformation in stabilising agriculture livelihoods in the region.

Working Strategy of Tank Management Committees

TMC Meeting Calendar

Table 6.1 TMC Cropping season wise wise Calendar

Season	Key Activities
Kharif	Conducting general body meetings to finalise the agenda and action plan for the kharif season.
	Tank site visit before the monsoon to identify breaches and undertake repair work before the onset of monsoons.
	Groundwater monitoring every month.
	Develop a proposal for water resource management, including repair of tanks under MGNREGA, well repairs, drinking water, etc., and submit the proposal to the Gram Sabha.
	Developing plans and extending support to bio-resource centres, seed banks, mobilising farmers to adopt climate-smart agricultural practices.
Rabi	Conducting general body meetings and finalising the agenda and action plan for Rabi season and water management.
	Rabi planning – conducting exercise in water budgeting with support from gram panchayat.
	Developing a plan and extending support to the use of bio-resource centres and seed banks by farmers to encourage climate-smart agricultural practices.
	Giving advisory on crop and variety selection and facilitating Rabi procurement.
	Monitoring village water structures and planning their repair, if needed.
	Collection of tank maintenance charge from beneficiary households in-cash/in-kind.
	Groundwater monitoring on monthly basis.
Zaid	Conducting general body meeting and finalising agenda and action plan for Zaidseason and water management.
	Zaid planning – conducting exercise in water budgeting with support from gram panchayat.
	Developing plan and extending support to use of bio-resource centres and seedbanks by farmers to encourage climate-smart agricultural practices.
	Groundwater monitoring on monthly basis.
	Developing the proposals for the Gram Sabha – convergence opportunity with the line departments.
	Formulating norms on maintaining dead storage level in tank and other water harvesting structures.
	Mobilising gram panchayat for taking up soil and water conservation work in the villages as per submitted proposal.

Step 2: Desilting Tanks

Tank rejuvenation should be approached considering both technical and social aspects. As a first step, tank silt is removed. The excavated silt is transported to the farms (it costs the community almost three times it costs in excavation). Therefore, active participation of community is the key. Silt removal from tanks and its use in farms, in addition to increasing water harvesting capacity of the tanks, results in a) better crop productivity and b) increase in groundwater recharge. It is to be noted that if excavated silt is not removed, it again reaches the tank.

Fig 6.3 Tank de-siltation process

Step 3: Promoting Climate-Smart Agriculture for better Soil Health and Climate Resilience

However, silt application alone will not maintain the soil health. After three to four years, its nutrients deplete. To maintain soil fertility, organic compost application is a must. In this, Water Champions (local Community cadres) helped orient the community to switch to natural farming methods and use of local seeds. Women played a key role in this transformation by promoting a network of Bio-resource Centres and Seed Banks while a group of progressive farmers adopted climate-smart agricultural practices (Fig 6.3).

Working Strategy of Tank Management Committees

Fig 6.4 Working Approach for Climate-smart agriculture

Step 4: Promoting Farm-Based Livelihoods

The region witnesses seasonal migration. Year-round livelihood engagement of the farmers is therefore essential for creating ownership of water availability.

Fig 6.5 Strategy of promoting farm-based livelihood models for small farmers

Communities planned interventions such as developing small orchards and initiating vegetable cultivation. As stakes for water increased, so did the ownership and concern to manage it well for the benefit of all.

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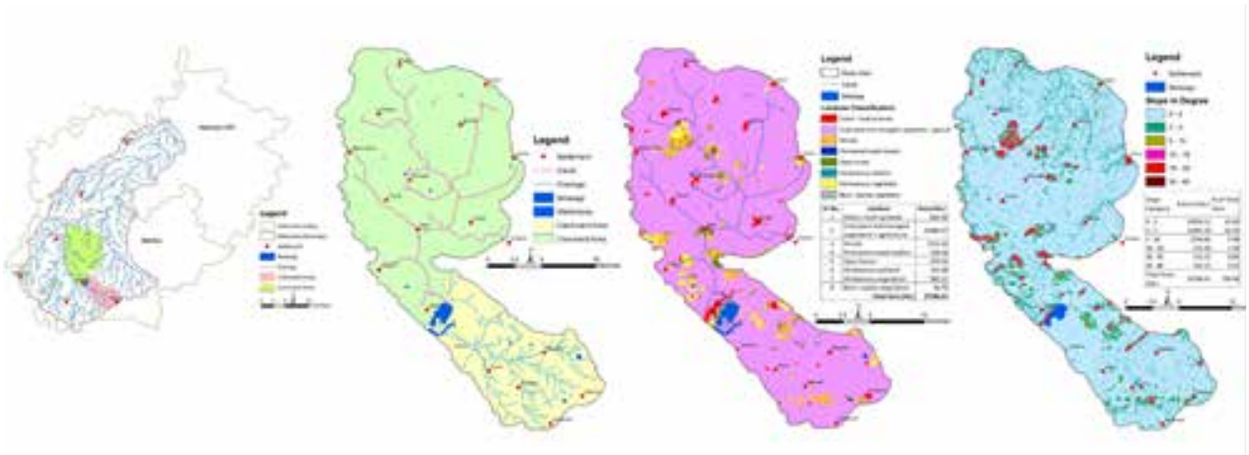
Annexure: 1

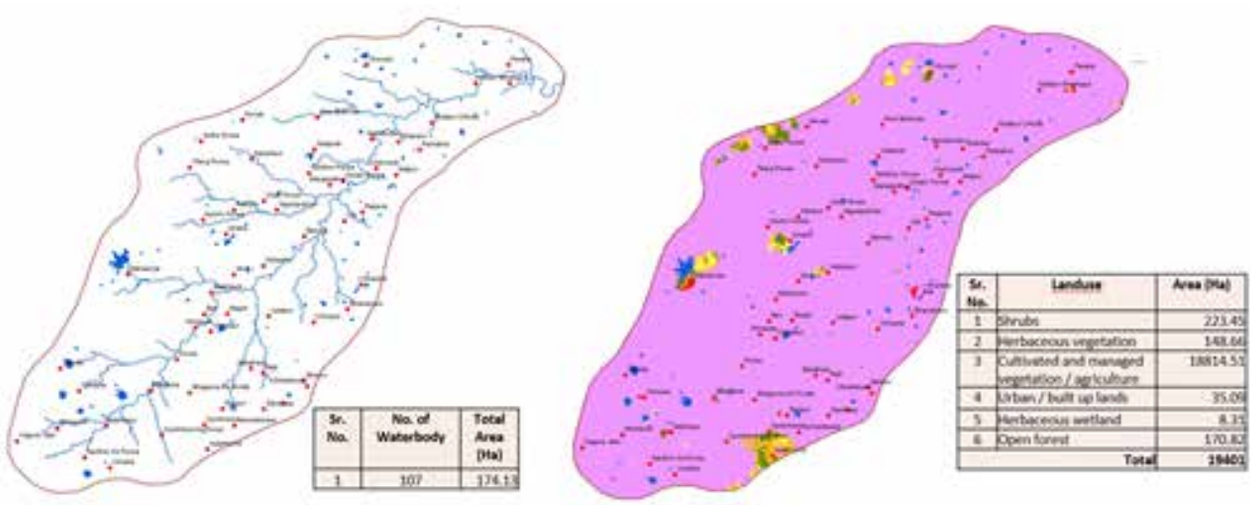
District wise Land Use Classification of Bundelkhand

DISTRICT	SHRUBS	HERBA-CEOUS VEGETA-TION	CULTIVAT-ED AND MANAGED VEGETA-TION / AGRICUL-TURE	URBAN / BUILT UP LANDS	BARE / SPARSE VEGETA-TION	PERMA-NENT WATER BODIES	HERBA-CEOUS WETLAND	CLOSED FOREST, DECID-UOUS BROAD LEAF.	CLOSED FOREST	OPEN FOREST, DECID-UOUS BROAD LEAF	OPEN FOREST	TOTAL
Banda	1644	6960	413409	8402	2372	10933	1664	1654	199	232	3885	**451352**
Chhatarpur	81619	20230	637491	5165	1645	1677	3282	52439	2237	15680	49222	**870686**
Chitrakut	13808	4941	227958	1687	1020	847	1167	38237	700	2991	14537	**307892**
Damoh	143240	34003	406472	3638	439	905	2886	27057	1721	24569	89911	**734841**
Datiya	6529	5606	234440	4673	60	10	1435	1286	487	225	4390	**259140**
Hamirpur	1213	7021	398623	7988	2803	2396	2115	187	147	41	3387	**425922**
Jalum	1831	6866	428315	9520	3498	1620	1277	59	99	6	3922	**457013**
Jhansi	10432	11864	453525	15763	1281	1950	3010	445	225	141	8063	**506700**
Lalitpur	18856	11832	420738	4005	6147	7290	2593	13441	985	4462	14746	**505094**
Mahoba	730	593	26009	538	35	70	188	13	4	3	474	**28657**
Newari	9848	7628	102674	2344	131	382	1374	26	33	74	3132	**127646**
Panna	88376	16163	363842	3872	344	697	2411	93415	6834	33738	100764	**710456**
Sagar	74865	27884	752026	9732	1290	1788	2316	50138	5019	20166	80397	**1025620**
Tikamgarh	37738	18676	307153	2655	285	653	2584	122	57	194	8946	**379063**
Total	**490729**	**180267**	**5172675**	**79982**	**21350**	**31218**	**28301**	**278518**	**18747**	**102521**	**385775**	**6790082**

Priority wise Cascade Identification- Mahoba District, UP



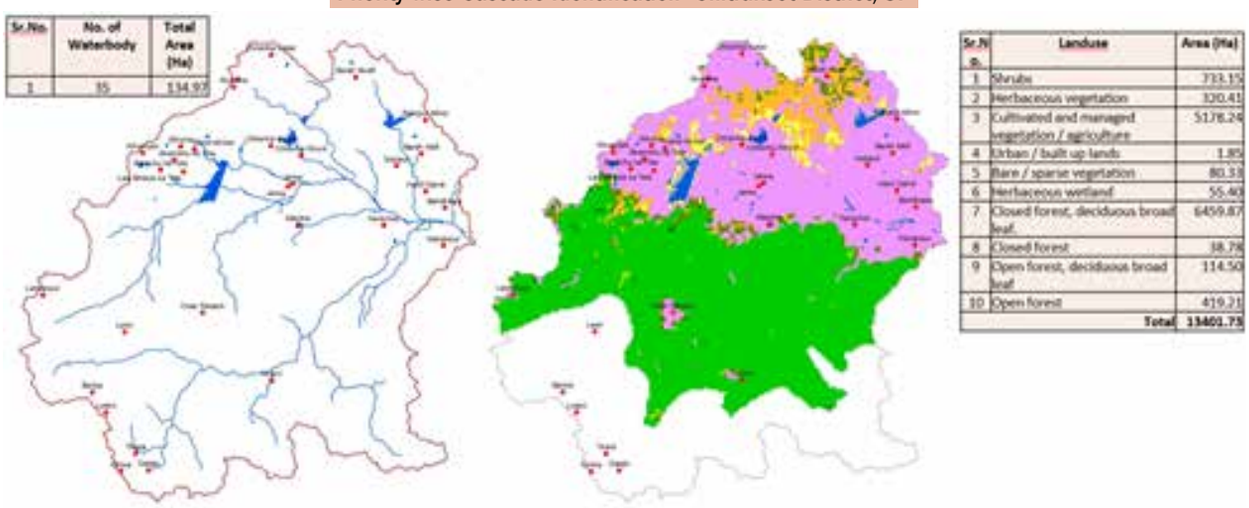
Priority wise Cascade Identification- Chhatarpur District, MP



Sr. No.	No. of Waterbody	Total Area (Ha)
1	107	174.13

Sr. No.	Landuse	Area (Ha)
1	Shrubs	223.45
2	Herbaceous vegetation	148.64
3	Cultivated and managed vegetation / agriculture	18814.53
4	Urban / built up lands	35.09
5	Herbaceous wetland	8.35
6	Open forest	170.82
	Total	19401

Priority wise Cascade Identification- Chitrakoot District, UP

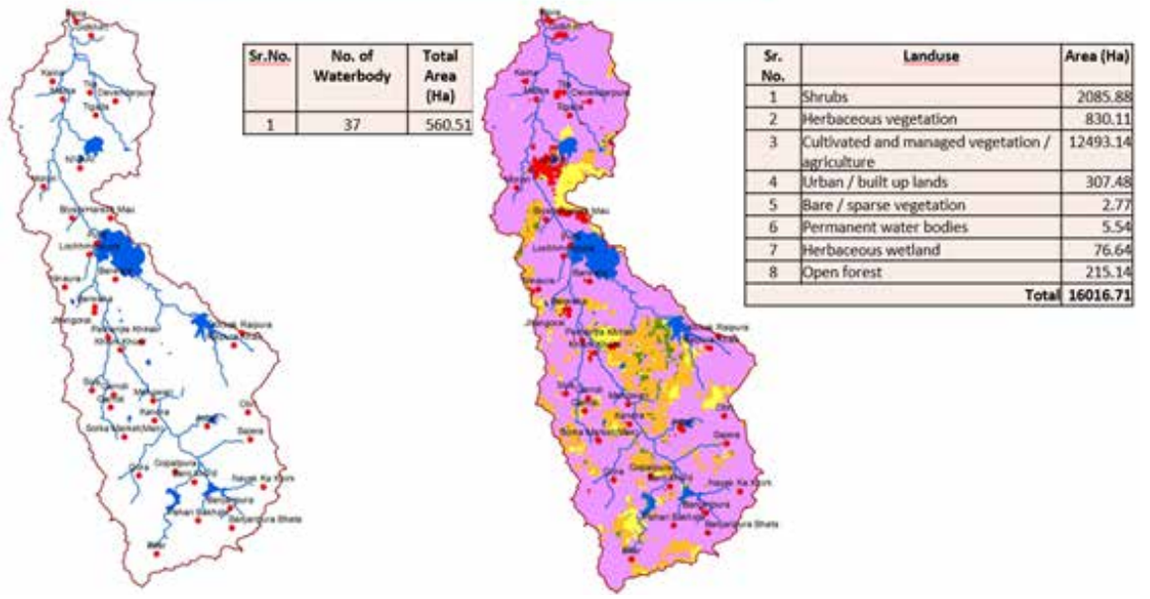


Sr.No.	No. of Waterbody	Total Area (Ha)
1	15	134.93

Sr.No.	Landuse	Area (Ha)
1	Shrubs	733.15
2	Herbaceous vegetation	320.41
3	Cultivated and managed vegetation / agriculture	5176.24
4	Urban / built up lands	1.85
5	Bare / sparse vegetation	80.53
6	Herbaceous wetland	55.40
7	Closed forest, deciduous broad leaf	6459.87
8	Closed forest	38.79
9	Open forest, deciduous broad leaf	114.50
10	Open forest	419.21
	Total	13401.75

Fig. 2.1 Watershed and Landuse Map of Selected Cascades of Mahoba, Chhatarpur and Chitrakoot Districts of UP – Bundelkhand

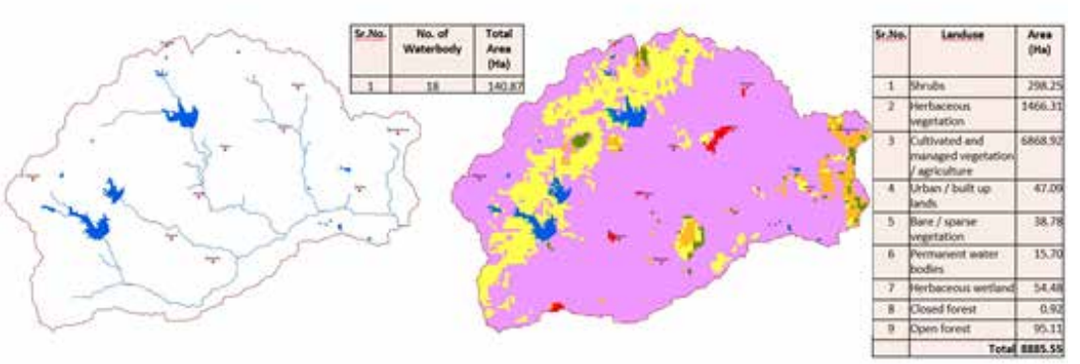
Priority wise Cascade Identification- Newari District, MP



Sr.No.	No. of Waterbody	Total Area (Ha)
1	37	560.51

Sr. No.	Landuse	Area (Ha)
1	Shrubs	2085.88
2	Herbaceous vegetation	830.11
3	Cultivated and managed vegetation / agriculture	12493.14
4	Urban / built up lands	307.48
5	Bare / sparse vegetation	2.77
6	Permanent water bodies	5.54
7	Herbaceous wetland	76.64
8	Open forest	215.14
	Total	16016.71

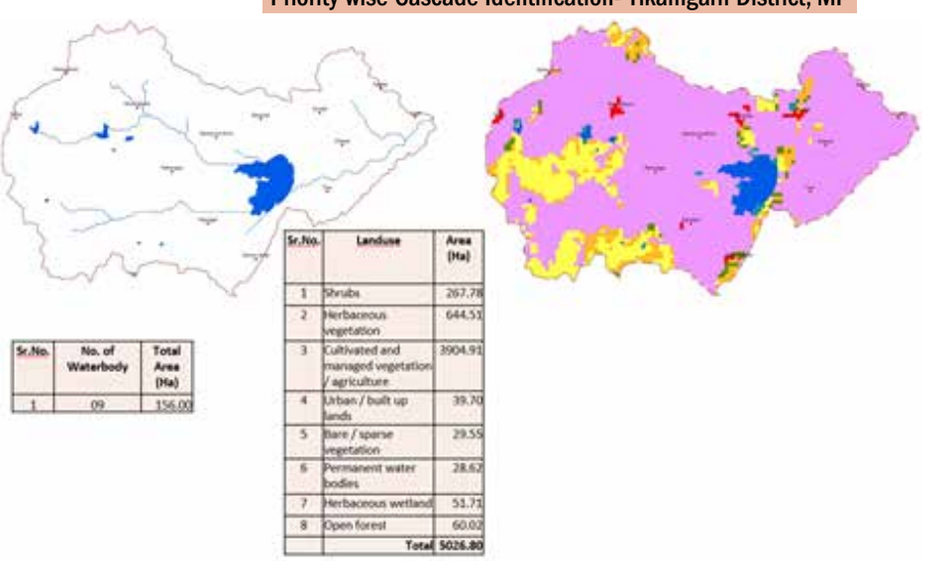
Priority wise Cascade Identification- Sagar District, MP



Sr.No.	No. of Waterbody	Total Area (Ha)
1	18	140.87

Sr.No.	Landuse	Area (Ha)
1	Shrubs	298.25
2	Herbaceous vegetation	1466.31
3	Cultivated and managed vegetation / agriculture	6868.92
4	Urban / built up lands	47.09
5	Bare / sparse vegetation	38.78
6	Permanent water bodies	15.70
7	Herbaceous wetland	54.48
8	Closed forest	0.92
9	Open forest	95.11
	Total	8885.55

Priority wise Cascade Identification- Tikamgarh District, MP



Sr.No.	No. of Waterbody	Total Area (Ha)
1	09	156.00

Sr.No.	Landuse	Area (Ha)
1	Shrubs	267.78
2	Herbaceous vegetation	644.51
3	Cultivated and managed vegetation / agriculture	3904.91
4	Urban / built up lands	39.70
5	Bare / sparse vegetation	29.55
6	Permanent water bodies	28.62
7	Herbaceous wetland	51.71
8	Open forest	60.02
	Total	5026.80

Fig. 2.2 Watershed and Landuse Map of Selected Cascades of Niwari, Sagar and Tikamgarh Districts of MP - Bundelkhand

IMPACT ON GROUND WATER:

	Downstream		Upstream		Right Side		Left Side	
	Water Level	Quality	Water Level	Quality	Water Level	Quality	Water Level	Quality
How many areas around the lake will be affected by the filling of this lake? (Write the distance in meters)								
Others								

UTILIZATION OF LAKE: (GIVING INFORMATION ABOUT NUMBER OF BENEFICIARIES, TIME AND AREA ETC.)

Drinking / Household Consumption (Number of Households, Months)	
Cattle (Number/Month)	
Cultivation (Number of Farmers/Area/ Number of Irrigation)	
Industry (Type of Use)	
Is the lake land used for other activities? Yes/No	

UTILIZATION OF LAKE: (GIVING INFORMATION ABOUT NUMBER OF BENEFICIARIES, TIME AND AREA ETC.)

Responsibility	use of water (Numbers of users)	Name of the pond maintainer	Is there a distribution system? If yes then describe the details separately	Who maintains catchment area? If yes then describe the details separately
Stakeholder (Personal)				
Stakeholder				
(mass)				
Society/Committee				
Gram Panchayat				
Government Department				
Other organizations				

PROBLEMS AND SOLUTIONS:

Area	Problems	Solutions
Catchment area		
Downstream		
Main Pond		
Infrastructure of distribution system		
Institutionalized distribution systems		

NAME AND MOBILE NUMBER OF SURVEYOR

Disclaimer:

This document has been produced with support from Hindustan Unilever Foundation. The views expressed herein are based on the Self Reliant Initiative Through Joint Action(SRIJAN)'s field experience during the tank rejuvenation in Bundelkhand areas and do not necessarily reflect any official policy or views of the Self Reliant Initiative Through Joint Action(SRIJAN) and Hindustan Unilever Foundation.

srijan सृजन

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