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Reclaiming Traditional Water Systems: Socio-Economic Impacts and Sustainable Strategies for Tank-Fed Agriculture in Karnataka

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Abstract: *Tank-fed agriculture, a practice rooted in India's ancient history, has played a critical role in the country's agricultural landscape. Originating during the Mauryan and Chola dynasties, tanks, or artificial reservoirs, were constructed to capture and store monsoon rains for irrigation, sustaining agricultural productivity and rural livelihoods. However, the advent of British colonial rule led to the neglect of these water management systems, adversely affecting agriculture. Post-independence, efforts were made to revive and modernize tank irrigation systems, but the Green Revolution of the 1960s shifted focus towards high-yield crops, reducing the reliance on traditional tank-fed agriculture. In recent years, there has been a resurgence of interest in sustainable water management, recognizing the importance of revitalizing tank-fed agriculture to ensure water availability, mitigate drought effects, and support rural livelihoods. This study examines the water management practices in the Nerale Panchayaths of Karnataka, focusing on the potential of water interventions and their socio-economic impacts. The research highlights the critical role of tanks in sustaining agriculture in these regions, particularly in the context of water scarcity and drought. It also underscores the challenges posed by inadequate infrastructure, such as the improper bund surrounding the Halepur tank, which leads to water overflow and disrupts farming activities. The study employs a mixed-methods approach, utilizing primary data collection through participatory rural appraisal (PRA) and secondary data from government offices and local leaders. The findings emphasize the need for comprehensive water management strategies, including tank renovation, de-siltation, and the removal of encroachments, to enhance the capacity and functionality of these traditional water systems.*

Overall, the study provides insights into the historical significance of tank-fed agriculture, the challenges faced during the modern era, and the renewed efforts to integrate sustainable water management practices to bolster rural development in Karnataka.

Key Words: *tank fed agriculture, rural livelihood, sustainable agriculture, traditional water system.*

1. INTRODUCTION:

Agriculture is a vital source of livelihood in many regions, including Mysore District, Karnataka. Water availability plays a crucial role in sustaining agriculture, with irrigation systems like tanks and wells being central to farming. Mysore has a total of 52,514 water bodies, including 937 tanks and 50042 tube wells, essential for agricultural activities. Nerale Panchayath comprises three villages, each with a unique socio-economic landscape shaped by its reliance on agriculture, daily wage labour, and additional income sources such as livestock. Through the study's primary data collection via participatory rural appraisal (PRA) and secondary data obtained from government offices, panchayat leaders, the DHAN federation, and existing literature, we aim to provide an in-depth understanding of the challenges and opportunities associated with tank-fed agriculture and water management in this region. The interconnectedness of water availability, livelihoods, and economic stability is evident through a historical lens, reflecting the transition from pre-drought prosperity to the challenges faced during and after periods of water scarcity. It underscores the pressing need for sustainable water management practices and resilience-building strategies to mitigate the adverse effects of environmental shocks. In villages like Nerale, Halepur, and Hampapur, agriculture is the primary occupation, with crops like jowar, sunflower, and paddy being widely cultivated. However, issues such as droughts and improper water

management have hindered productivity. The Halepur Tank, covering 241.31 acres, is key water source for these villages but has faced deterioration over time, impacting local livelihoods. This study aims to explore the potential of water intervention programs and sustainable agricultural practices, focusing on improving water management and infrastructure to enhance agricultural productivity and ensure economic stability for farming communities in this region. However, the tank faces challenges due to an improper bund (embankment) that causes water overflow into nearby farmlands, disrupting agriculture. Despite efforts by the Panchayat under the MGNREGA scheme, only a portion of the tank has undergone siltation, leaving issues with water flow unresolved. To restore its functionality, tank renovation, including de-siltation, repairing leaks, and strengthening the bund, is crucial for maintaining water capacity and supporting sustainable farming in the region.

2. LITERATURE REVIEW:

1. Delineation of ground water potential zones in a hard rock terrain of mysore district, Karnataka using IRS data and GIS techniques.

The study uses remote sensing, GSI base maps, and geographic information systems to assess Mysore district's groundwater prospects. Amphibolite schists, gneiss, and granite dominate the lithology, while landforms like hills and valleys influence groundwater availability. Groundwater is excellent in valley areas but moderate to poor elsewhere.

2. Community Based Tank Management Project Consultancy Services (CBTMPCS) unit of the University of Agricultural Sciences, Bangalore.

CBTMPCS of the University of Agricultural Sciences, Bangalore, improved agricultural output through horticulture crop demonstrations in tank systems. This increased crop intensity by 44.95%, water use efficiency by 40.82%, and productivity by 40.03%. Organic farming and contract farming boosted farmers' livelihoods by improving soil health and returns.

3. Assessment of watersheds for sustainable agriculture in Karnataka, India

This study modernized small-scale irrigation tanks in Karnataka using stakeholder input to prioritize restoration for future water demand. Tanks were assessed based on hydrology and environmental conditions, with a large-scale lift irrigation scheme evaluated. The findings can enhance water resource management in Southeast Asia through spatially referenced hydrological outputs.

4. Encroachment of watershed Area of tanks in Karnataka: Magnitude, Causes and Consequences by P. Thippaih 2006– Agricultural Economics Research Review

Thippaih's 2006 study examines how encroachment on tank watershed areas in Karnataka has reduced their viability. Factors include population growth and agriculture, leading to dysfunctional tanks. The study explores encroachment causes, consequences, and potential solutions to restore these vital water bodies for irrigation and drinking needs.

3. OBJECTIVES / AIMS :

- To study the existing traditional water resources and their status of utility.
- To study the Scope, need and potential for water intervention.
- Integrated plan for conservation and development

4. RESEARCH METHOD / METHODOLOGY :

Research The study focused on Nerale Panchayath in Nanjangud taluk and Somanathpur Panchayath in Narsipur block of Mysore District, Karnataka. The study period spanned from July 8 to August 11, 2023. Agriculture is the main livelihood, with major crops like jowar and cotton. Both panchayaths benefit from MGNREGA schemes, with water interventions and infrastructure improvements.

Sampling design and data collection

Included primary data sources like focus group discussions (FGDs) with farmers and women about tank usage, field enquiries in Halepur and Kaglipur villages, case studies, and structured questionnaires to gather insights on tanks and agriculture.

Data collection

Various data collection tools were employed, including structured and unstructured interview schedules, as well as the Participatory Rural Appraisal (PRA) tools. Pre-testing was conducted to ensure the effectiveness of the interview schedule, with a draft version administered to at least 10 respondents. Based on pre-test responses, modifications were made to the interview schedule to enhance clarity and relevance. The pre-test data were excluded from the final study.

Data analysis

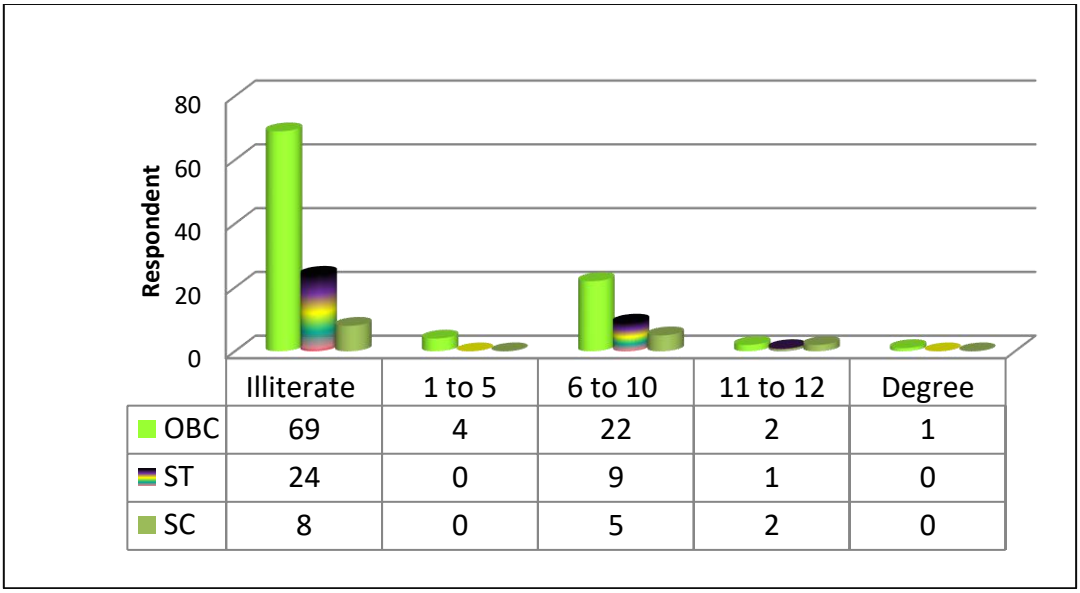
data analysis, both primary and secondary data were used, including statistical data from the Mysore district, panchayat and taluk offices, literature reviews, and reports from the agriculture department.

5. RESULT / FINDING :

The research findings, along with additional online data, provide a clear understanding of the current state of traditional water management systems in rural areas. The study emphasizes the important role tanks play in tackling water scarcity and supporting agriculture. By combining both qualitative and quantitative data, the research offers valuable insights into how effective interventions can help restore these systems and improve the community's ability to cope with challenges.

Socio –Economic status

The socio-economic section provides a thorough analysis of the demographic and economic features of the study area. It gives a clear overview of the village profiles, including details on population size, literacy rates, caste distribution, housing conditions, gender ratio, and main occupations.



	Illiterate	1 to 5	6 to 10	11 to 12	Degree
OBC	69	4	22	2	1
ST	24	0	9	1	0
SC	8	0	5	2	0

chart 1 Caste and Education

Government schemes

Sl. No	Schemes	Panchayath	Halepur
1	Awas yojan	25 household	5
2	Basava vasathi	30	8
3	Ambedkar vasathi	10	4
4	Toilets	All	All
5	Bore wells	37	9
6	Mini tanks	25	7

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Primary occupation

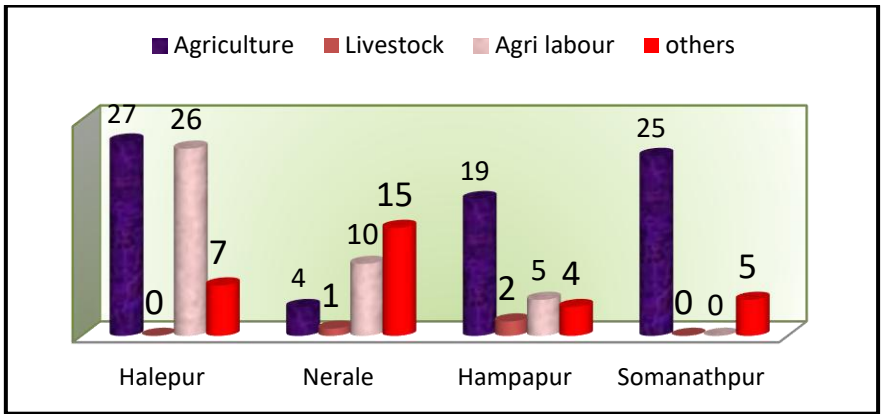

chart 2 - Primary Occupation

Agriculture seems to be a significant occupation in Halepur and Hampapur, with 27 and 19 individuals respectively engaged in it. However, it is less prevalent in Nerale with only 4 individuals. Livestock activities are limited, with only 3 individuals engaged across all three locations. The highest number of individuals work as agricultural laborers in Halepur, followed by Nerale and Hampapur. category encompasses activities beyond agriculture and livestock. The highest number of individuals in this category is in Nerale, followed by Halepur and Hampapur. The total population varies across the three locations, with Halepur having the highest population of 60 individuals, while Nerale and Hampapur each have a population of 30 individuals.

Annual Income

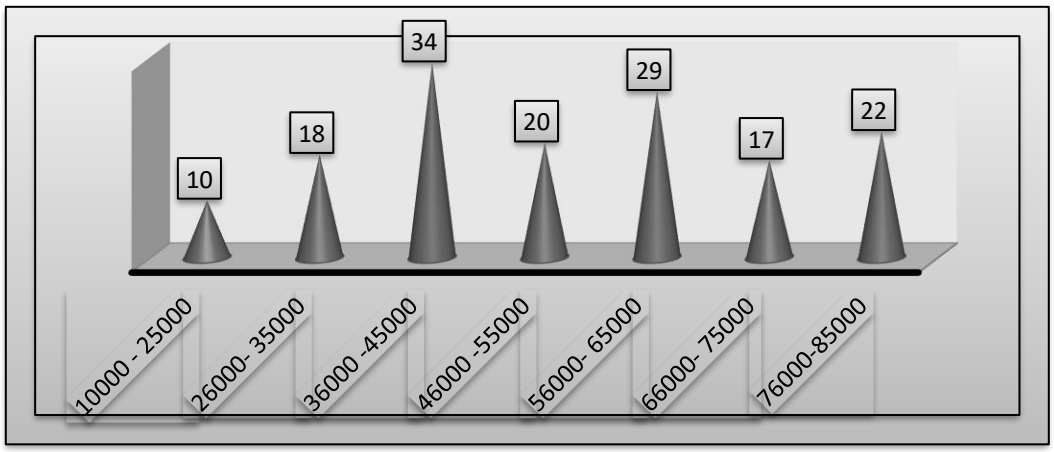

chart 3 Annual Income

Livestock population

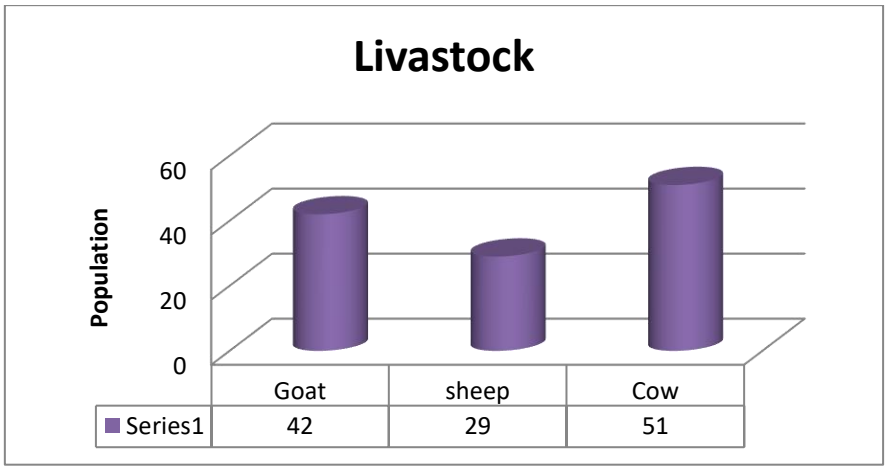

chart 4 Livestock Population

The livestock population analysis indicates that cows are the most prevalent, constituting 43% of the total livestock, highlighting their importance in local agricultural and dairy practices. Goats account for 36%, showcasing their role in providing meat and supplementary income, especially in resource-scarce conditions. Sheep represent 21%, emphasizing their contribution to wool production and livelihoods. The distribution reflects a balanced reliance on livestock diversity to support the community's economic and sustenance needs.

Water consumption per day

Livestock	Per day
Goat	4 – 7 ltr
Sheep	4 – 14 ltr
Cow	15-20 ltr

Table 1 Water Consumption by Livestock

Agriculture

Land	**Acres**
Total land	1496.17
Barren land	382.28
Cultivable land	1113.29

Table 2 land details

The table shows that in total acres of land most of the land has been using for agriculture. Rest of the land they are using for graveyard, small water bodies and some of the land under the government authority.

Land categorisation

Village	**Marginal**	**Small**	**Dry land**	**Rain fed**	**Bore well**	**water from others**
Halepur	55	5	0	37	17	6
Nerale	o	2	20	2	0	0
Hampapur	11	3	7	5	8	0

Table 3 Farmers details

The data highlights the agricultural patterns in the three villages. In Halepur, 55 farmers are marginal, 37 rely on rain-fed agriculture, and 17 use borewells, indicating a dependence on natural and underground water sources. In Nerale, small farmers dominate with 20 practicing dry land farming, and no reliance on borewells or external water sources is observed. Hampapur shows a mix, with 11 marginal farmers, 7 practicing dry land farming, and 8 using borewells, reflecting moderate resource diversity.

Rainfall

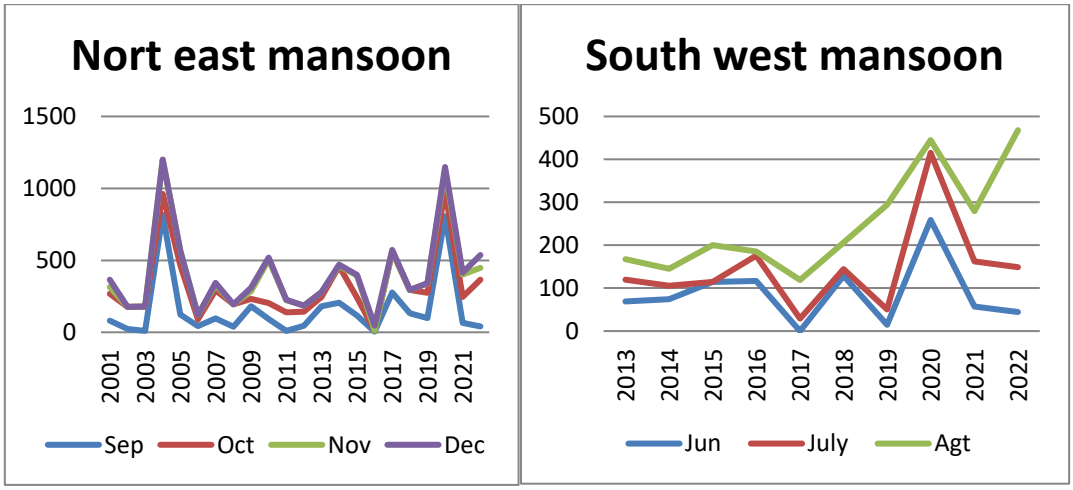

Table 4 Rainfall data

Cropping Pattern

Panchayat	Bore well			Rain fed irrigated			Water from others		
	Acres	crops	Yield	Acres	crop	Yield	Acres	crop	Yield
Nerale	5	Flower	56 tq	11	Jower	24 qt	6	Flower	50 kg
	6	Banana	120 ton	7	Jower & sunflower	50 qt	1	Jower	40 kg
	28	Flower & Banana	105 qt	11	Jower	0			

Table 5 Cropping Pattern

The research study highlights variations in irrigation methods and crop yields in Nerale village. Borewell irrigation supports high-yield crops like bananas (120 tons) and flowers (56 tq), demonstrating its efficiency for water-intensive farming. Rain-fed agriculture yields 24 qt of jowar and 50 qt of jowar and sunflower, showing moderate productivity despite limited water access. Crops reliant on water from other sources, such as flowers (50 kg) and jowar (40 kg), indicate lower yields, emphasizing the need for reliable irrigation. The data underscores the role of water sources in determining crop selection and productivity levels in the region.

Land use and land cover in agriculture on particular study village

SL.no	Crops	Rain fed	Bore well	Total
1	Jower	585.23		585.23
2	Cotton	199.23		199.23
3	Sunflower	18-21.08		18-21.08
4	Chilli	9.08		9.08
5	Corn	40.38		40.38
6	Coconut		42.10	42.10
7	Green gram	13.09		13.09
8	Sugarcane		30.20	30.20
9	Chrysanthemums		53.23	53.23
10	Fallow	42. 87		42. 87
11	Banana		20	20
12	Marigold		28.05	28.05
13	Turmeric		7.08	7.08
14	Tomato		6.08	6.08
	Total area	**925.14**	**188.15**	**1113.29 acres**

Table 6 Land use and Land cover

The table Indicates the agricultural landscape's reliance on both rainfed and bore well irrigation methods. This mixed approach highlights a strategy to mitigate risks associated with rainfall variability while maintaining crop diversity.

Seasonality

crops	**Mar**	**Apr**	**May**	**June**	**July**	**Aug**	**Sep**	**Oct**	**Nov**	**Dec**	**Jan**	**Feb**
Jower	Ploughing			Sowing	Weeding	Fertilizer		Harvesting	Sorting			

Sunflower	Ploughing			Sowing	Weeding	Fertilizer		Harvesting	Sorting			
	Sep	**Oct**	**Nov**	**Dec**	**Jan**	**Feb**	**Mar**	**Apr**	**May**	**June**	**July**	**Aug**
Banana	Ploughing				Sowing	Fertilizer		Weeding	Harvesting	Sorting		
Chrysanthemum	Ploughing				Sowing	Fertilizer		Weeding	Harvesting	Sorting		

Table 7 Seasonality

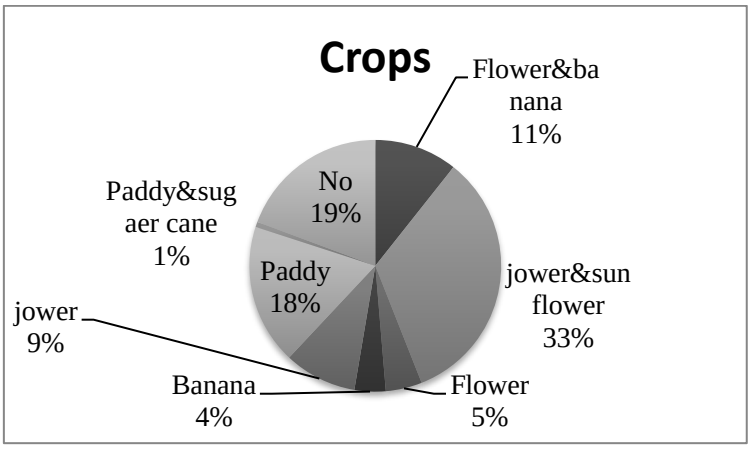

chart 5 Crops

The crop distribution study shows that jowar and sunflower are the most widely cultivated, covering 33% of the area, indicating their importance as staple crops. Flower and banana cultivation together account for 11%, reflecting their value in mixed cropping systems. Standalone flower and banana farming represent 5% and 4%, respectively, showing limited adoption, possibly due to higher input requirements or market dependency. Jowar alone covers 9%, emphasizing its role as a staple grain. Paddy and sugarcane cultivation together make up just 1%, suggesting minimal adoption, likely due to water or resource constraints.

Study on Water bodies - Tank
Halepur Tank

Source	**Halepur tank**
Water capacity	0. 15 TMC
Catchment area	1529 acres
Command area	750 acres
Water spread area	446 acres
Depth of tank	2 feet
Total area	345
Water source	Kabini river basin

chart 6 Halepur tank

TREND Analysis of water bodies

Trend	1980	1990	2010	2023
Water	Filled up to 20%	No water	No water	Sufficient for domestic use
Rain	Adequate	No rain	No rain	Moderate
Command area	Good	No water	No water	Good
Bund	Not good	Not good	Not good	Not good
Drought	No	yes	Yes	Yes
Usage of tank	All	Only for domestic and livestock	Only for domestic and livestock	Only for domestic and livestock

chart 7 trend analysis of water body

The region faced a water crisis from 1990 to 2010, characterized by low water availability, insufficient rainfall, and adverse impacts on agriculture and domestic use. Drought conditions persisted throughout these years, further aggravating the water scarcity situation. Although water availability for domestic use improved by 2023, the area still experienced moderate rain and ongoing challenges in ensuring water availability for broader uses. The consistently poor condition of the bund implies a need for improved water management infrastructure. The indicates a history of water scarcity and its cascading effects on various aspects of life in the region. While there has been some improvement, water management and infrastructure remain crucial concerns for sustainable development.

Usage of water bodies

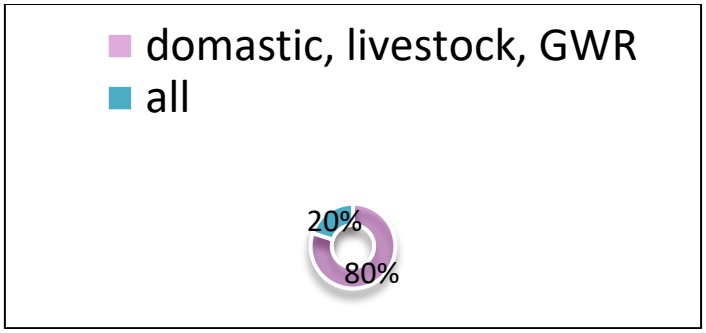

chart 8 Purpose of water use

Risk in water sources

Before drought	During drought	After drought
• Cropping pattern • Paddy, ragi, cotton, jower • All accessing tank water for agriculture • Ground water level was high. (60 feet) • Income – Rs 200000 per year	• Livelihood diversification- agriculture labour and construction work • No adequate water for livestock • Scarcity of drinking water	• Cropping pattern • Jower, sunflower, Chrysanthemum flower • Decrease in yield • Water Not getting for agriculture • Ground water level is low • Income - Rs 40000 per year

Table 8 Risk in Water bodies

SWOT analysis

Strength	Weakness
• Accessibility for domestic and feed the livestock. • Since 9 years water flowing from Kabini river basin	• Tank bund is not good in condition. • No siltation work

Opportunity	Threats
• Bore wells recharge. • Increase the ground water level. • Fishing (tender – 400000)	• If tank filled, that time farmers can't do farming who have land near by tank. • Negligence of Panchayath • Water not allow to use for agriculture • Drought

Table 9 SWOT Analysis

Scope and need for intervention
Issues

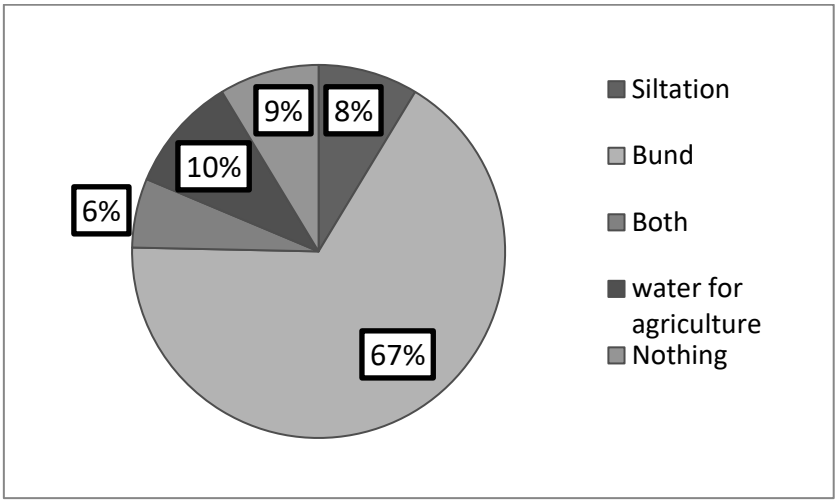

chart 9 Scope and need for intervention

The main issue in Halepur is the improper bund surrounding the tank. Three years ago, the Panchayat carried out siltation work under the MGNREGA scheme, but it covered only one-fourth of the tank area. Because of the improper bund, water from the tank overflows into nearby farmland, making it difficult for farmers to cultivate their land. Villagers also face problems rearing livestock, as they cannot cross the tank area safely. Although Halepur has a farmers' association, it is currently inactive and not addressing these issues.

Integrated plan for intervention
To address the issues with the tank, an awareness program about its importance can be conducted for the villagers. Tank renovation work, including de-siltation and bund strengthening, is essential to ensure proper water management and support farming activities. Ten Agricultural Finance Groups (AFGs) can be formed to promote collaboration among farmers. Committees can be established to oversee tank maintenance and ensure sustainability. Additionally, removing encroachments around the tank area will help restore its functionality and benefit the entire village.

6. DISCUSSION / ANALYSIS:
Research highlights the importance of traditional tank-fed water systems in rural Karnataka, particularly in sustaining agriculture and supporting livelihoods. The study identifies critical challenges, such as improper bunds, partial de-siltation, and encroachments, that hinder the functionality of tanks like Halepur. Insights from qualitative and quantitative data emphasize the need for targeted interventions, including bund strengthening, comprehensive tank renovation, and active community participation. These efforts are crucial for enhancing water availability, improving agricultural productivity, and building community resilience against water scarcity and drought conditions.

8. CONCLUSION:
Agricultural practices vary significantly across the villages based on resource availability and landholding patterns. Halepur relies heavily on rain-fed farming, while Nerale predominantly practices dry land farming without additional water sources. Hampapur shows moderate diversity in water usage with a mix of rain-fed and borewell irrigation. These

findings highlight the need for targeted interventions to improve water management and support small and marginal farmers for sustainable agriculture.

10. RECOMMENDATIONS:

- **Comprehensive Tank Renovation**: Undertake complete renovation of tanks, including de-siltation, bund strengthening, and leak repairs, to enhance their water-holding capacity and support sustainable farming.

- **Formation of Active Committees**: Establish village-level committees involving farmers, Panchayat members, and technical experts to oversee tank maintenance and management.

- **Promotion of Agricultural Finance Groups (AFGs)**: Encourage the formation and active participation of AFGs to mobilize resources, address funding challenges, and enhance agricultural productivity.

- **Awareness and Training Programs**: Conduct regular awareness campaigns on water management and provide training for farmers on sustainable practices and tank-based agriculture.

- **Encroachment Removal**: Address encroachments around tank areas to restore their original catchment and command areas, ensuring fair access for all stakeholders.

- **Long-Term Maintenance Plans**: Develop and implement detailed maintenance plans, including regular monitoring, to ensure the sustainability of the tanks over time.

- **Integration with Government Schemes**: Leverage existing government programs like MGNREGA to fund large-scale interventions and infrastructure development in tank-fed agriculture.

- **Climate Resilience Measures**: Incorporate strategies to address climate variability and its impact on water availability and agricultural practices.

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