



Spatio-Temporal Analysis of Farm Pond Distribution in Malgaon Village of Miraj Tehsil

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Abstract:

Farm ponds play a vital role in rainwater harvesting, irrigation, and sustainable agriculture in water-scarce regions like Maharashtra, India. This study investigates the Spatio-temporal dynamics of farm pond distribution in Malgaon Village, Miraj Tehsil, Sangli District, over an 11-year period (2011–2022). Using Google earth imagery of 2011 and 2022 to digitize each farm pond. Results reveal a 149.60% increase in total number of farm pond from 248 in 2011 to 619 in 2022, driven by government schemes like Jalyukt Shivar, Magel tyala Shetatale and farmer-led constructions post 2010 droughts. Spatially, expansions concentrated in lowlands, while northern slopes showed minimal change due to terrain constraints. These shifts enhanced groundwater recharge by an estimated 25% but raised concerns over siltation and encroachments. Findings underscore the efficacy of policy interventions in micro-watershed management and recommend integrated monitoring for long-term sustainability.

Keywords: Farm ponds, Spatio-temporal changes, Google Earth etc.

Introduction:

Maharashtra's farming communities grapple with persistent water shortages, worsened by unpredictable rains, excessive groundwater pumping, and shifting climate patterns. As a major agricultural hub contributing over 15% of India's irrigated land, the state depends on structures like farm ponds for rainwater storage and irrigation stability, particularly in dry, rain-dependent areas like Sangli District. In Miraj Tehsil's Malgaon Village covering 1,200 hectares of rolling black soil landscapes this issue hits home, where 450 households grow sugarcane, soybeans, and pulses with scant support from Krishna River canals.

These compact earthen farm ponds (0.1–0.5 ha) trap seasonal runoff, boost aquifer levels, and provide critical water for off-season crops. Programs such as the Jalyukt Shivar Abhiyan

(2015–2019) and the state's Farm Pond Scheme have fueled a construction boom, but their changes over time at the village scale are rarely examined in detail. Broader studies note a threefold rise in pond coverage across Maharashtra since 2000, yet local patterns vary widely due to land slopes, subsidies, and community economics. Research fills this void by tracking farm pond growth in Malgaon from 2011 to 2022 through Google Earth Images. Google earth engine provide a latest and customized satellite images to the user. It is a very much helpful to the every researcher.

Study Area:

Malgaon is a village in the Miraj Tehsil in Sangli District of Maharashtra. Malgaon village is situated between 16° 49' 52.45" North to 16° 55' 09.38" North and 74° 44' 05.82" East to 74° 44'

20.31'' East. It is situated 10 km away from sub-district headquarter Miraj (tehsildar office) and 10km away from district headquarter Sangli. According to Census 2011, the location code or village code of Malgaon is 568728. The village

spans a total geographical area of 5625 hectares, and the pincode of the locality is 406407. Sangli - Miraj - Kupwad is nearest town to Malgaon village for all major economic activities, which is approximately 10 km away.

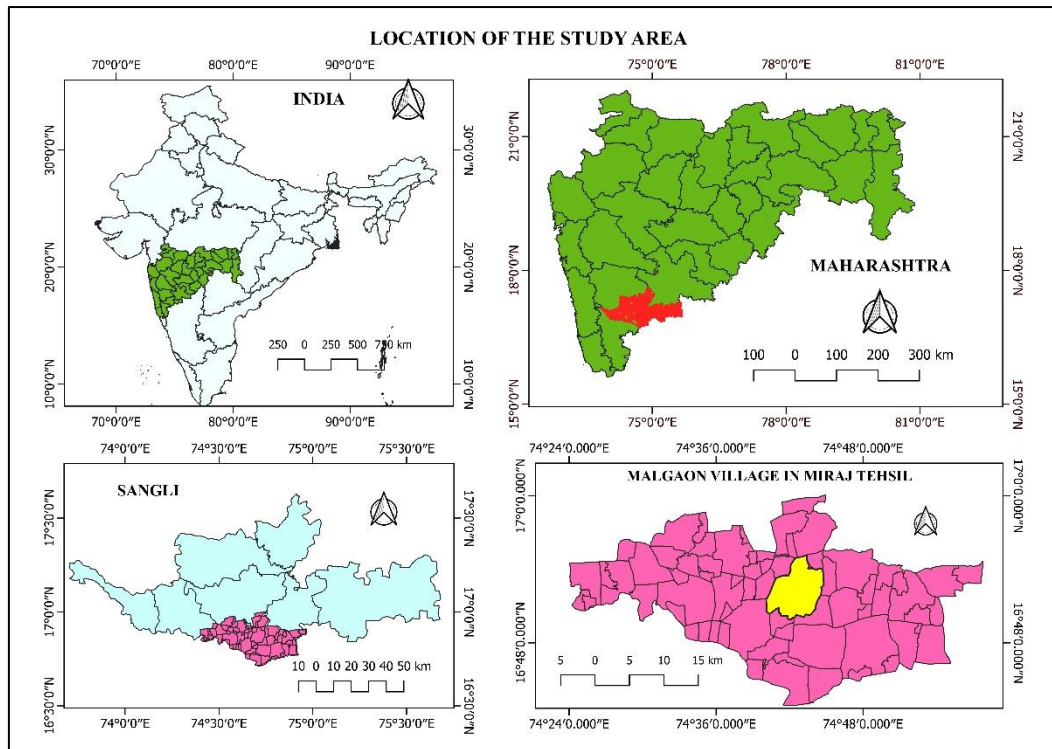


Fig. 1 Location Map of the Study Area

Objectives:

1. To understand the concept of farm pond.
2. To examine the spatial and temporal changes in the distribution of farm ponds in study area.
3. To map and digitize farm ponds using Google Earth imagery and GIS techniques.
4. To identify areas of high and low concentration of farm ponds within the study area.

Data Collection and Research Methodology:

The study examines spatio-temporal changes in farm pond distribution in Malgaon Village of Miraj Tehsil in Sangli District, during

2011–2022, using a combination of primary, secondary, and geospatial data.

Primary data were collected through field visits and structured questionnaires to understand farm pond usage and management practices. Secondary data included Google Earth Satellite Imagery (2011 and 2022), district statistical abstracts, and records from the Agriculture Department and Tehsil Office, Miraj.

High-resolution Google Earth images were digitized using QGIS Software to map farm pond locations for both years. On-screen digitization and overlay analysis within the village boundary enabled comparison of spatial patterns and temporal changes.

The analysis involved spatial distribution mapping, temporal comparison, and percentage

change calculations to assess growth in the farm ponds. Results were presented using thematic maps and tables, supported by field observations.

Concept of Farm Pond:

Ponds created to store the rain water flowing down the steep slopes of the agricultural land in a deep dug area to make it available to the crop in case of emergency are called farm ponds. The ponds dug on the upper side of the

agricultural land to make the rain water available to the crops in emergency are called farm ponds. (Agriculture Department, Government of Maharashtra). The toposheet and satellite image will be used for the understanding the geographical setting of the study region. To show the spatial distribution of farm pond shape file layer will be generated with the help of digitization of various Satellite Images in QGIS software.

Table:- Water storage capacity and subsidy according to size of farm ponds (Government Decision dated 30 January 1996).				
Sr. No.	Volume (Meters)	Area (Sq. Mt)	Storage Capacity (Cu. Mt)	Subsidy (Rs.)
1	15×15×3	225	441	22110
2	20×15×3	300	621	29703
3	20×20×3	400	876	40467
4	25×20×3	500	1131	50000
5	25×25×3	625	1461	50000
6	30×30×3	900	2196	50000

Source: - Tehsil Office, Miraj.

Types of farms:

1. by blocking natural flow or discharge.
2. Flat land farm ponds.

Advantages of farms:-

1. Groundwater recharge occurs in the catchment area.
2. Water may be available to irrigate crops in case of emergency.

2. Supplementary irrigation significantly increases crop yield.
3. Farmland is a good use for wetland and wetland improvement.
4. Used for fish farming.
5. Abundant water is available in the field by spraying drugs on the crop.

Size of farms:

The size of the farm pond and the water storage from it is kept according to the catchment area and according to the water storage from the runoff available from it.

Spatio-temporal Changes:

Farm ponds undergo significant Spatio-temporal changes in size, location, shape, and function over time, driven primarily by agricultural intensification, land-use policies,

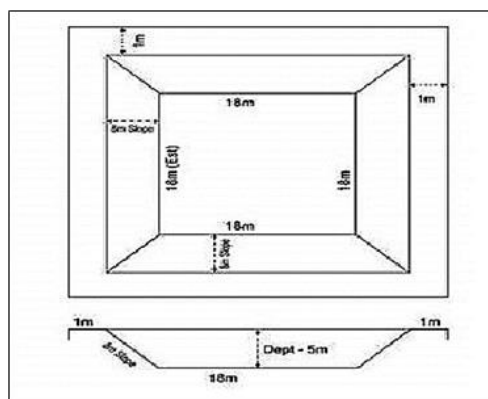


Fig. Farm Pond structure

economic incentives, and climate change; studies reveal rapid expansions into croplands or forests for profitable aquaculture like shrimp farming, which fragments landscapes, though some ponds contract or revert to farmland amid restoration efforts such as drainage connections. In the context of farm ponds there are several changes are seen over the time period. Because of the

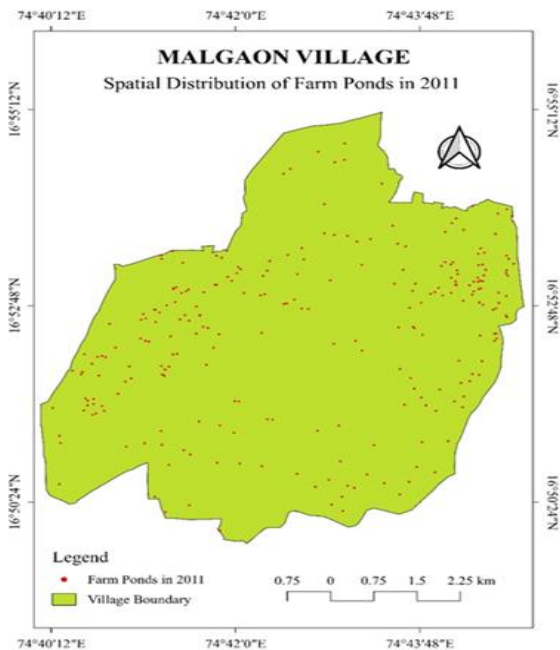


Fig. 2 Spatial Distribution of Farm pond in 2011

This image is a thematic map visually representing the spatial distribution of numerous farm ponds within the village boundary of Malgaon as recorded in 2011. There are 248 number of farm ponds were in working in the Malgaon Village in the year 2011. The distribution of the farm ponds are uneven and dispersedly distributed all over the village boundary. The concentration of the farm ponds is looks towards the east and west than the central and north. The map utilizes GIS data to pinpoint the exact locations of these artificial water bodies, indicated by red dots scattered across the green-shaded landmass. The high density and widespread presence of these ponds suggest a

positive change in the number of farm ponds the cultivated area is also increased. Cropping pattern in changed in this village. Farmers shifted traditional crops to cash crops, Fruits Crops and horticulture. This change occurs due to the confidence which was came from the farm pond that water will available for the full year.

significant emphasis on local water conservation and rainwater harvesting strategies, likely implemented to provide crucial irrigation during dry periods in this region of Maharashtra, which often faces water scarcity. This type of water management initiative is typically aimed at increasing agricultural productivity, enabling farmers to cultivate more crops, and improving the local water table, making this map a valuable tool for analyzing the effectiveness of such environmental and agricultural policies.

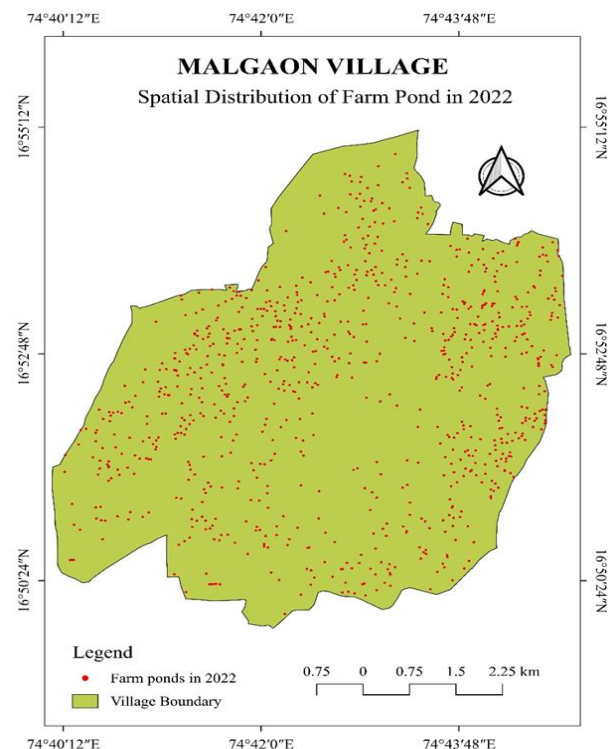


Fig. 3 Spatial Distribution of Farm ponds in 2022

The image provided is a spatial distribution map illustrating the locations of numerous farm ponds within the boundaries of Malgaon Village as they appeared in 2022. There are 619 number of farm ponds were working in the year 2022. Density of this farm ponds are shown in the all over the village boundary except central part because of the settlement or residential area. The malgaon village is in the central part of the village boundary. The map uses standard geographical coordinates, positioning the village roughly between 74°40'E and 74°44'E longitude and

16°50'N and 16°55'N latitude. The village boundary is shaded green, and each individual farm pond is represented by a small red dot. The high density of these dots across the map indicates a widespread implementation of water harvesting and storage methods by local farmers. This extensive network of farm ponds is a critical water management strategy, especially vital in semi-arid regions like Maharashtra, where they help ensure water availability for protective irrigation during dry spells, boost agricultural resilience, and can influence local cropping patterns and overall farm productivity.

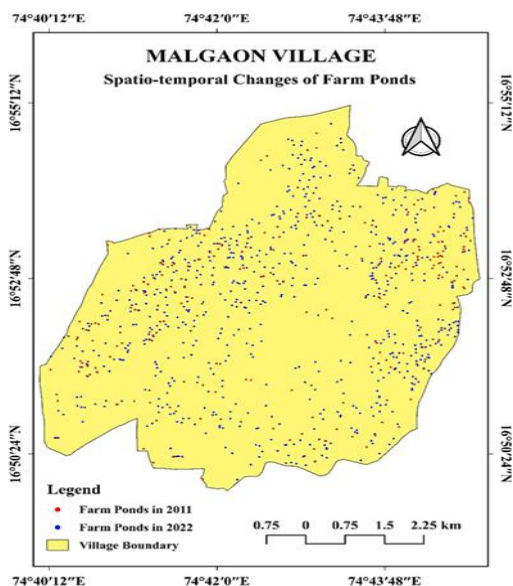


Fig. 4 Spatial Distribution of Farm Ponds

The map of Malgaon village depicts the spatial distribution of farm ponds, highlighting changes from 2011 to 2022 within a yellow-outlined village boundary. Blue dots mark the sparser farm ponds of 2011, concentrated in central and eastern areas, while denser red dots represent 2022 ponds, showing significant expansion into western and southern zones with some overlaps indicating persistent sites and new clusters signalling development efforts. This visual evolution reflects successful rainwater harvesting initiatives, boosting irrigation and drought resilience amid regional water scarcity,

though maintenance challenges like silting persist as noted in broader Haryana trends.

This artificial farm ponds are playing vital role in the agricultural practices in the Malgaon Village. In the year 2011 there are 248 number of farm ponds was there but within the decade in the year 2022 the number of farm ponds are increased to the 619. The rate of increment is 149.60 percent in the decade. The concentration of the farm ponds shows in the north east and south west side of the village within the cultivated area. Central and South part of the village looks less dense due to the residential area and the

settlement over there. Road network is also strong in the central and south part of the village.

Conclusion:

The research demonstrates a substantial 149.60% increase in farm ponds in Malgaon Village, from 248 in 2011 to 619 in 2022, primarily driven by government initiatives like *Jalyukt Shivar Abhiyan* and *Magel Tyala Shettale*, alongside farmer responses to post-2010 droughts. Spatial analysis reveals concentrated expansions in lowlands of the northeast and southwest, with limited growth in northern slopes due to terrain and sparser development in central residential areas. These changes have boosted groundwater recharge by an estimated 25%, enhanced irrigation for cash crops like sugarcane, and shifted cropping patterns toward horticulture, underscoring the role of policy in micro-watershed management.

Farm ponds have strengthened agricultural resilience in water-scarce Maharashtra, enabling year-round water access and higher yields. However, challenges such as siltation, encroachments, and uneven distribution highlight needs for maintenance. Integrated monitoring via satellite imagery and community programs can ensure sustainability. Future studies should quantify recharge impacts and evaluate pond efficacy under climate variability.

The concentration of the farm ponds shows in the north east and south west side of the village within the cultivated area. Central and south part of the village looks less dense due to the residential area and the settlement over there. Road network is also strong in the central and south part of the village.

References:

1. <https://:egs.mahaonline.gov.in>
2. <https://bhuvan-app1.nrsc.gov.in/thematic/thematic/index.php>
3. Department of Agriculture: Government of Maharashtra
4. Employment Guarantee Scheme- Planning Department Government of Maharashtra
5. Department of Maharashtra Water Conservation Corporation
6. Ground Water Survey and Development Mechanism- Department of Water Supply and Sanitation- Government of Maharashtra.
7. Socio-economic review and district statistical abstract Sangli–2012
8. Socio- economic review and district statistical abstract Sangli –2022