

## Research Article

# Distribution of Ponds and Its Change Detection In Tehsil, Ranchi District, Jharkhand State, India

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## A B S T R A C T

Ponds serve multiple purposes in the biosphere and are an essential element of the hydrological system. However, due to the ponds tiny dimensions, the study of their natural environments is frequently disregarded. Despite a doubt, many significant responsibilities in our life are carried out by small activities. Ponds offer environmentally friendly responses to a few of the most significant issues associated with managing water and climate change. Distributing ponds delivers a more equitable distribution of a region's water resources. By strategically placing ponds across several blocks, it becomes simpler to provide water necessities for diverse populations, especially throughout regions where water shortages are now an important issues. Digitizing ponds of 2013 and 2022 using Google Earth and overlaid the ponds over Tehsil, Ranchi District and calculate the change detection of Ponds.

**Keywords:** Ponds, Hydrology, Tehsil, Ponds Conservation, Wetland

## Introduction Summary and Conclusion

A huge worldwide danger to society and the economy is posed by the loss of biodiversity and the ensuing drop in ecosystem services, which can also play a significant role in the development of infectious illnesses (UNEP 2020). More species, especially uncommon and threatened, are helped by ponds than any other freshwater making them biodiversity hotspots (Indermuehle et al. 2008; Oertli and Parris 2019). As guardians of biodiversity and natural habitats, ponds in Ranchi district support a myriad of flora and fauna, creating vital ecosystems that foster ecological balance. Besides their environmental significance, these water bodies have been integral to the cultural and historical heritage of the region, being sites of religious and social importance for generations. Throughout the tehsils of Ranchi district, these ponds have been harnessed for various purposes, ranging from agricultural irrigation to meeting the water needs of local communities. The strategic placement of these water bodies has facilitated

efficient water management, contributing to sustainable agricultural practices and ensuring a stable supply of water in times of need.

Ponds offer environmentally friendly responses to a few of the most significant issues associated with managing water and climate change. Sediment, phosphorus, nitrogen are just a few of the scattered contaminants that ponds may remove from the water's surface (Cauchie HM et al 2014).

While the ponds have remained an essential aspect of rural life in Ranchi district, there have been ongoing efforts by the local government and environmental organizations to preserve and protect them. The problems faced by ponds in India, mostly from pollution and encroachment, have been discussed in the text. Based on outcomes of different pond reports, some suggestions have been discussed in the end of the manuscript for an effective pond conservation initiative, their sustainable management in India (Kumar M, Padhy P 2015).

Recognizing their value as natural reservoirs and habitats, conservation initiatives have sought to safeguard these ponds from encroachment and pollution, ensuring their sustenance for future generations. Ponds in Ranchi district serve as guardians of biodiversity and natural habitats, creating essential ecosystems that foster ecological balance. These water bodies support a rich variety of flora and fauna, providing breeding grounds for aquatic species and acting as important stopover points for migratory birds. Moreover, they enhance the overall biodiversity of the region, making Ranchi district an ecological hotspot.

In addition to their environmental significance, ponds in Ranchi district hold immense cultural and historical importance. Over the years, these water bodies have become sacred sites, revered for their religious and social significance. They serve as venues for religious ceremonies, cultural festivals, community gatherings, strengthening social bonds and preserving local traditions. The distribution of ponds in Ranchi district is well-planned, taking into account the diverse needs of the local communities. Strategically located across the tehsils, these ponds play a vital role in supporting agricultural activities. They serve as a reliable source of water for irrigation, enabling farmers to cultivate crops and ensuring food security in the region. The availability of water from these ponds has been crucial in transforming arid landscapes into fertile agricultural lands, thereby contributing to the economic prosperity of the district. Furthermore, the distribution of ponds in Ranchi district has been instrumental in efficient water management. These water bodies act as natural reservoirs, storing water during the monsoon season and releasing it gradually during dry spells. This sustainable water management system ensures a steady supply of water for domestic consumption, livestock rearing, other daily needs of the local communities. However, despite their immense importance, ponds in Ranchi district face various threats. Encroachment, pollution, unsustainable practices pose significant challenges to their preservation. These efforts aim to prevent encroachment, mitigate pollution, raise awareness about the ecological and socio-economic significance of the ponds. Such measures are essential for safeguarding these invaluable natural resources for future generations. However, as a result of rising human-caused stressors brought on by population development and demand for resources, such as urbanisation and intensification of agriculture, pond ecosystem numbers have decreased. The ecosystem services provided by the pond are also in danger due to the rising threats of invasion organisms & global warming. Between the turn of the century and 1980, ponds in the UK decreased by 75% in number (Riley et al. 2018).

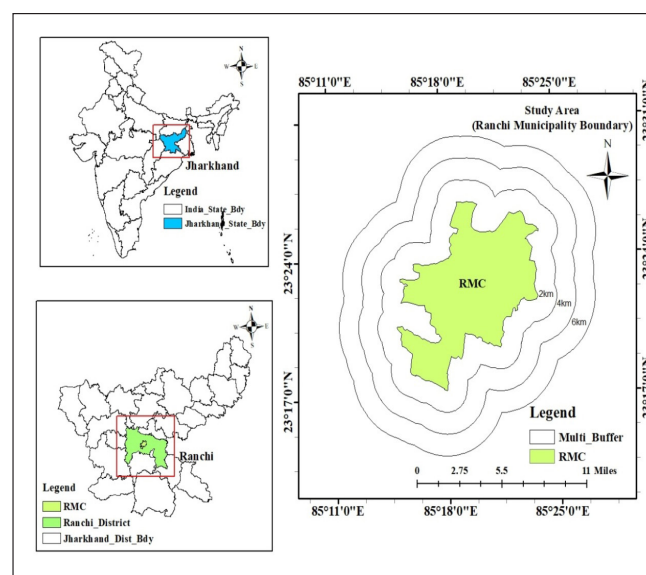
In conclusion, the distribution of ponds in Ranchi district is a testament to the region's natural beauty and its people's deep

connection with water. These water bodies, spread across the tehsils, provide vital habitats, sustain agricultural activities, hold cultural and historical significance. Preserving and protecting these ponds is crucial for maintaining ecological balance, ensuring sustainable development, upholding the rich natural heritage of Ranchi district. By recognizing their distribution and importance, we can strive to foster a harmonious coexistence between human development and the preservation of these invaluable ponds.

### Study Area Aims and Objectives

In the present study, water bodies (Ponds) were mapped using satellite data to determine how many of them lie in the specific classification and its analyses. The location is the area of Ranchi Municipal Corporation Boundary of Ranchi district, Jharkhand, India. Ranchi is the capital city of the Indian state of Jharkhand.

Ranchi district is located in the indigenous region of the Chotanagpur Plateau, is where it encompasses an area of 5025 km<sup>2</sup>. The state is bordered by the Districts of Chatra, Hazaribagh, Ramgarh in the north, West Bengal and Saraikela in the east, Khunti and Saraikela in the south, Latehar, Lohardaga, Gumla in the west. It is known as a city of waterfalls and lakes. Ranchi city lies between the latitudes of 22°52" and 23°43" north latitude and 84°51" to 85°55" east longitudes.



**Figure 1. Location map of the study area, Ranchi City, Jharkhand**

### Data Used

Data used for this study is tehsil distribution of ranchi district from Survey of India. The Survey of India (SOI) Toposheet no. 73A/14, 73A/15, 73A/16, 73E/2, 73E/3, 73E/4, 73E/6, 73E/7, 73E/8, 73E/10, 73E/11, 73E/12, 73E/15, 73E/16, 73F/9 and 73F/13 of the year, 1962 has been taken for the study for correlating with the current study.

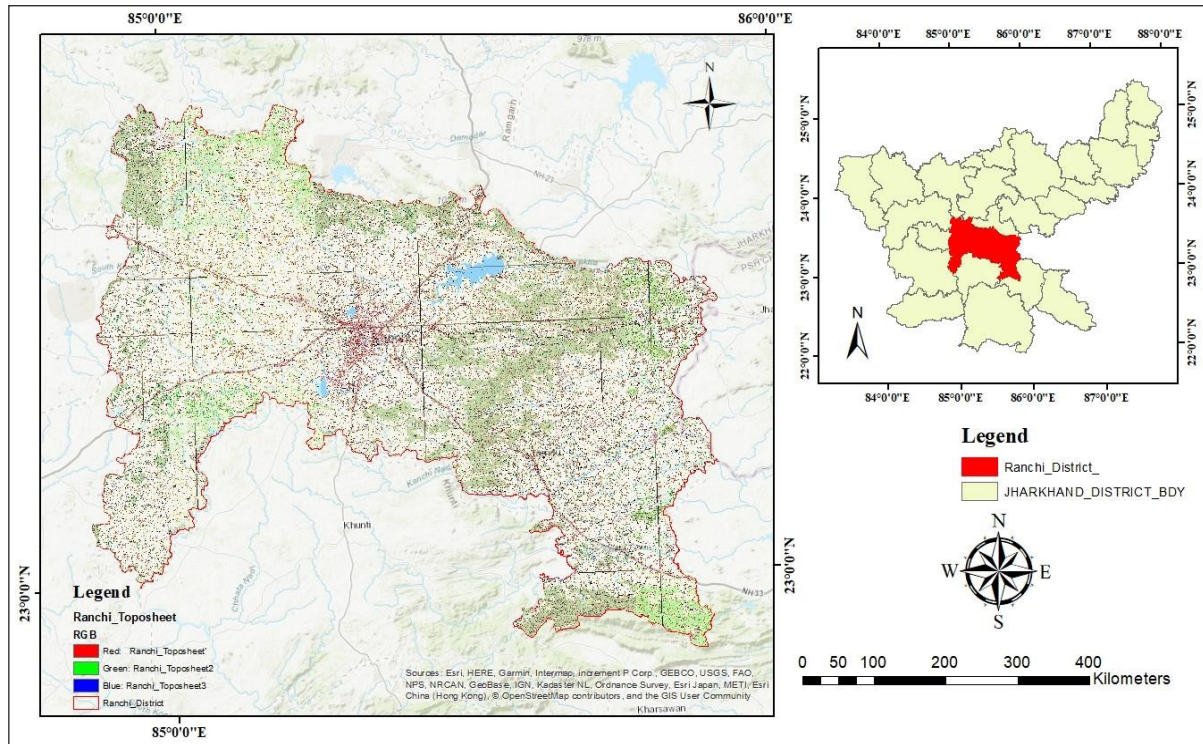


Figure 2. Mosaicked Toposheet of Ranchi district

## Aims and Objectives

The objective of the study is to know the distribution of ponds in Tehsil, Ranchi District and know the change of ponds in the year 2013 and 2022.

## Methodology

Ponds have been an essential component of India's settlement arrangement for over a century to serve as conventional water storage constructions (Meter et al. 2014).

For the study of extraction of ponds and its distribution in the specific tehsil of the Ranchi District shapefile of the district has been taken from Survey of India website also shapefile of Tehsil is also been taken from Survey of India. The ponds of the year 2013 and 2022 is digitized using Google Earth on the basis of time period. After digitizing ponds are being cross checked visually and then it has been overlaid on the Tehsil of the Ranchi District. On each tehsil ponds are extracted using extract by mask tool in Arc GIS software for both the year. After extracting dissolve tool is used to dissolve ponds of one tehsil in the attribute table likewise with all the extracted ponds of each Tehsil. Now, ponds of each Tehsil of both the year is intersected using intersect tool and there it gives change detection of the ponds.

## Results and Discussion

The water resources in an area are distributed more equally because of distributing ponds. It is made easier to offer water access to diverse populations by strategically putting

ponds across different blocks, especially in regions where shortages of water have become a serious concern. The ponds serve as nearby sources of water that may be used for several purposes, including cultivation, domestic usage and feeding animals. For the study of extraction of ponds and its distribution in the specific tehsil of the Ranchi District shapefile of the district has been taken from Survey of India website also shapefile of Tehsil is also been taken from Survey of India. For better study and analysis Ponds of the year 2013 and 2022 which was digitized in Google Earth with time period is overlaid over the Ranchi district Tehsil to see distribution of ponds are now the source of living for nearby area in Figure 3, 4 distribution of ponds shown with respect to Tehsil of 2013 and 2022. Extracting data on ponds in each tehsil contributes to water security planning.

It has been analyzed that The pond development could be an indication of improved oversight of water resources. A planned water management strategy may be the reason for the rise in ponds. Ponds may operate as retention basins for storage, capturing and maintaining extra drainage or rain. With this strategy, rainwater is better overseen, urban areas are less likely to flood, a more reliable water supply is guaranteed. It helps identify areas that may face water scarcity and those that have a surplus of water resources. This information is crucial for developing strategies to address water shortages, such as implementing water conservation measures, exploring alternative water sources, or distributing water resources equitably across the district.

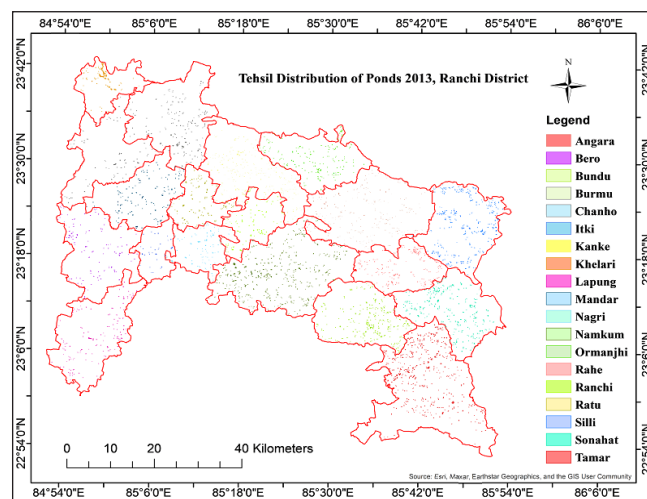
To accommodate irrigation requirements, ponds may be constructed or extended in agricultural regions. The accessibility of water supplies for livestock, farming, other purposes may be affected by having fewer ponds as a result of reducing water storage capacity. Landscapes that occur on their own frequently clear way for facilities buildings, roads as urbanization and development develop.

**Table 1. No. of ponds extracted in respect to Ranchi District Tehsil 2013 and 2022**

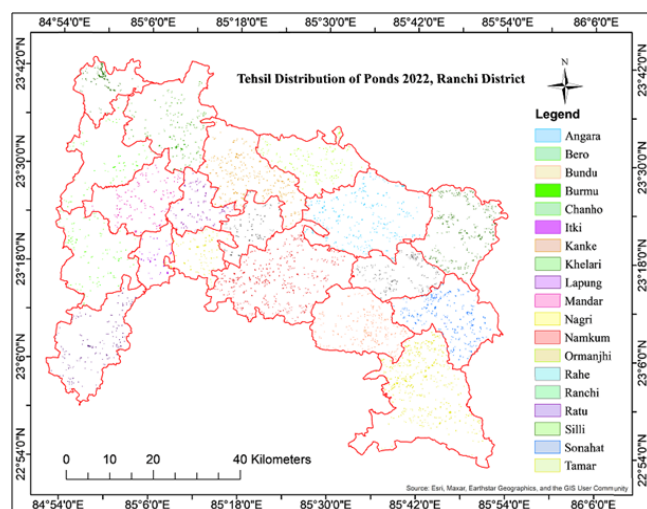
No. of ponds extracted in respect to Ranchi District Tehsil 2013 and 2022				
Tehsil	Area of Tehsil	No. of Ponds 2013	No. of Ponds 2022	Ponds Dynamics
Angara	385.41	375	378	3
Bero	278.96	138	138	0
Bundu	256.75	312	323	11
Burmu	311.79	176	176	0
Chanho	255.09	101	101	0
Itki	93.71	31	36	5
Kanke	427.89	537	532	-5
Khelari	127.63	104	104	0
Lapung	290.68	185	185	0
Mandar	228.44	133	133	0
Nagri	125.79	99	105	6
Namkom	444.91	558	570	12
Ormanjhi	220.99	217	220	3
Rahe	177.11	298	298	0
Ratu	128.44	127	133	6
Silli	279.72	407	407	0
Sonahatu	264.32	388	388	0
Tamar	496.75	539	539	0

For the reason of constructing a residence, an organization, or a manufacturing plant, ponds may be covered in or drained. As a result of this procedure, fewer ponds are present in the region as a whole. In table it has been seen when it compares 2013 and 2022 ponds it has been seen that mostly ponds have been increased in areas like Bundu, Namkom, Ratu etc. ponds are increased it is because there are many ponds are constructed in recent years. A comprehensive programme named IWMP has been put into existence in India to assist with the challenges of conserving water and soil, sustainable land management, the enhancement of rural livelihoods. Although building waterbodies is one of the measures for managing watersheds that the IWMP emphasizes, it is important to keep in mind that precise plans and methods can change

based on circumstances and needs. In the tehsil Kanke with is of an area 427.89 km<sup>2</sup> had 537 ponds in the year 2013 and in 2022 it has 532 ponds it has been decreased by 5 ponds as most of the development carried is in the Kanke tehsil of the Ranchi district as RMC boundary is also in the Kanke block. To evaluate the impact and efficacy of the built-in waterbodies, continuous monitoring, evaluation.



**Figure 3. Distribution of ponds of 2013**



**Figure 4. Distribution of ponds of 2022**

### Summary and Conclusion

Ponds support a diverse range of plant and animal species, including amphibians, aquatic insects, birds, aquatic vegetation. The distribution of ponds across a district ensures the preservation of various habitats, contributing to the conservation of biodiversity and promoting ecological balance. Ponds act as natural reservoirs, storing water during periods of rainfall and releasing it gradually during drier periods. The distribution of ponds helps ensure the availability of water for various purposes, including irrigation, drinking water, livestock rearing. Efficient water management through the strategic placement of ponds

can mitigate water scarcity and support sustainable agricultural practices. Ponds play a crucial role in recharging groundwater reserves. The distribution of ponds in a district allows rainwater to percolate into the ground, replenishing the water table. This helps maintain the water levels in wells, boreholes, underground aquifers, which are important sources of water for both rural and urban communities. Conservation and restoration initiatives focused on wetland ecosystems may involve the creation or restoration of ponds. These efforts aim to enhance biodiversity, improve water quality, restore natural habitats. Such projects can lead to an increase in the number of ponds in an area. Urbanization is also the reason for decreasing ponds.

The distribution of ponds in a district brings numerous benefits, including biodiversity conservation, water availability and management, flood control, livelihood support, recreational opportunities, cultural preservation, erosion control. Understanding and managing the distribution of ponds is crucial for sustainable development, environmental conservation, improving the overall well-being of communities.

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