



## Assessment of Anthropogenic Pressure on Shivnibandh Lake in Sakoli tehsil of Bhandara district in Maharashtra, India based on GIS and field Investigation for Conservation and Management

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### Abstract: -

This work utilizes RS & GIS and field investigated data for the study of Shivnibandh Lake. To evaluate the effects of various factor as per the conservation and Management point of view. Study approaches is based on Geospatial Technology with special emphasis on NDWI (Normalised Difference Water Index) of Shivnibandh Lake in Sakoli Tehsil of Bhandara District in central India landscape. The previous study of (V. P. Bawankule and L. P. Nagpurkar, 2021), Assessment & Monitoring of Surface Water in Wetlands of Sakoli Tehsil, suggested the overall water bodies, its water holding capacity of Sakoli tehsil and areas are decreasing continuously. Therefore, in this study we have focused on Largest Lake in Sakoli Tehsil. We worked on NDWI based Conservation and Management for rural wetlands, an expert opinion-based model which will further help in policy making at local administration, NGO or at Governmental level. Moreover, the Wetland submerge area decreased with the increase of the proportion of the degree of human disturbance to great extent. Result of this study reveals that, 49.12% of loss of Submerge area in 30 years from 1989 to 2019. This is a spatiotemporal evaluation of surface water study correlates and focused on and establishing relationship between Submerged area and Anthropogenic pressure. Here we proposed a framework to protect, conserve and its management w.r.to the Wetland its Natural ecosystem and restore the effective habitat to achieve Sustainable Development Goals (SDG).

**Keywords – Remote Sensing and GIS, Geospatial Technology, NDWI, Conservation and Management, Shivnibandh Lake, Anthropogenic Pressure.**

### I. INTRODUCTION: –

Wetlands not only provide promiscuous ecological goods but also provides services form local to global level. Some of the most important ecosystem goods include water for irrigation, water supply, aquaculture, non-timber forest produce, recreation etc. and important services include carbon sequestration, flood control, ground water recharge, nutrient cycling, soil profile improvement and biodiversity maintenance etc. [1]–[3] . Worldwide surface water quality is governed by complex anthropogenic activities and natural processes such as climate change, erosion, hydrological features, industrial activities, precipitation, agricultural practices, sewage discharge, and the huge exploitation of water resources by humans. Over and above that, result into shrinking in their size as well as a decline of the hydrological, economic, and ecological functions they perform [3]–[7].

As per previous literature study in last decade, decline in water quality of inland aquatic systems is reporting due to very rapid development of industries, urbanization, agriculture etc. In India there is no as such separate well established legal provision for wetland conservation [8]. Nevertheless, the major reasons behind the absence of a proper legal instrument on wetlands could be a limited understanding among policy makers, NGO and at Governmental level regarding the need for recognizing wetlands as unique ecosystem as well [8]–[10].

United Nations Sustainable Development Goals (SDGs), established framework on September 15, 2015 popularly called as “Transforming our world: the 2030 Agenda for Sustainable Development” SDG 6, 7, 12, 13, 14 and 15 are directly related to environmental sustainability[9], [11], [12]. Across the globe several studies have previously reported decline or local loss of

biodiversity around the world, but the available data, mythology, tools, case studies have been inadequate to reliably quantify this decline[12]. Apart from obtaining good-quality information on biodiversity across the globe, assessment and monitoring are to identify the most essential, which possess a challenging because such information is patchy, inadequate and incomplete [13], [14]

The previous study of (V. P. Bawankule and L. P. Nagpurkar, 2021), Assessment & Monitoring of Surface Water in Wetlands of Sakoli tehsil, suggested that, the overall water bodies and its water holding capacity of Sakoli tehsil Wetlands and areas are decreasing continuously. Therefore, in this study we have focused on one of largest Lake in Sakoli Tehsil. Study approaches is based on Geospatial Technology with special emphasized on NDWI (Normalised Difference Water Index) of Shivnibandh Lake in Sakoli Tehsil of Bhandara District in central Indian Landscape. We worked on NDWI based Conservation and Management for rural wetlands an expert opinion-based model which will further help in policy making at Agency, NGO or at Governmental level. We proposed a modified GIS technology-based framework for protect and conservation and Management of the Natural aquatic Ecosystem and also to regenerate and restore the effective habitat to achieve Sustainable Development Goals (SDG) and for prosperous life of mankind.

## II. MATERIALS AND METHODOLOGY: -

### 2.1 Study area:--

The study is carried out at Shivnibandh Lake of Sakoli Tehsil of Bhandara district in Maharashtra state in India. Study area is lies between 21.003397° N, 79.9903° E (Figure 1) is located near the forest corridor of NNTR, connecting Nagzira Wildlife Sanctuary in northern side and Navegaon National Park in eastern side in central Indian landscape[15]. Submerged area of Shivnibandh lake is 489.60 hectare and the irrigation potential is 1852 hectare. The adjoining forest is dry deciduous type. This is one of the Largest Wetland in Sakoli Tehsil of District Bhandara. Also, it is famous tourist spot located approximately 8 km from the Sakoli city in District Bhandara for its scenic beauty. It has a mixed economy including agriculture, aquaculture, bricks manufacturing, lotus root removal etc.[16] Moreover, particularly both Bhandara and Gondia district is known for its Wetlands and Paddy fields (main agriculture crop), forest and mineral resources. Therefore, the study area has an ecologically enormous potential to carry out further research concerned. Several ancient temples and historical monuments, along with Lakes, Parks and Sanctuaries etc. Sakoli is well surrounded by hills, forest, lakes, ponds and rivers [15], [17], [18].

### 2.2 Data used: -

In this study the required data was obtained from United States Geological Survey (USGS, www.usgs.gov). Two data sets, Landsat 5 TM of 1989 and Landsat 8 OLI images of the month January of year 1989 and 2019 respectively, downloaded and use for this study (Table 1).

Table 1 : Satellite images used for study area

| Sr. No | Satellite Sensor | Acquisition date | Spatial resolution (m) | Path/Row | Spectral Band Used       |
|--------|------------------|------------------|------------------------|----------|--------------------------|
| 1      | Landsat 5 TM     | 14/01/1989       | 30                     | 143/45   | 0.52-0.60µm (Green band) |
| 6      | Landsat 8 OLI    | 17/01/2019       | 30                     | 143/45   | 0.77-0.90 µm (NIR band)  |

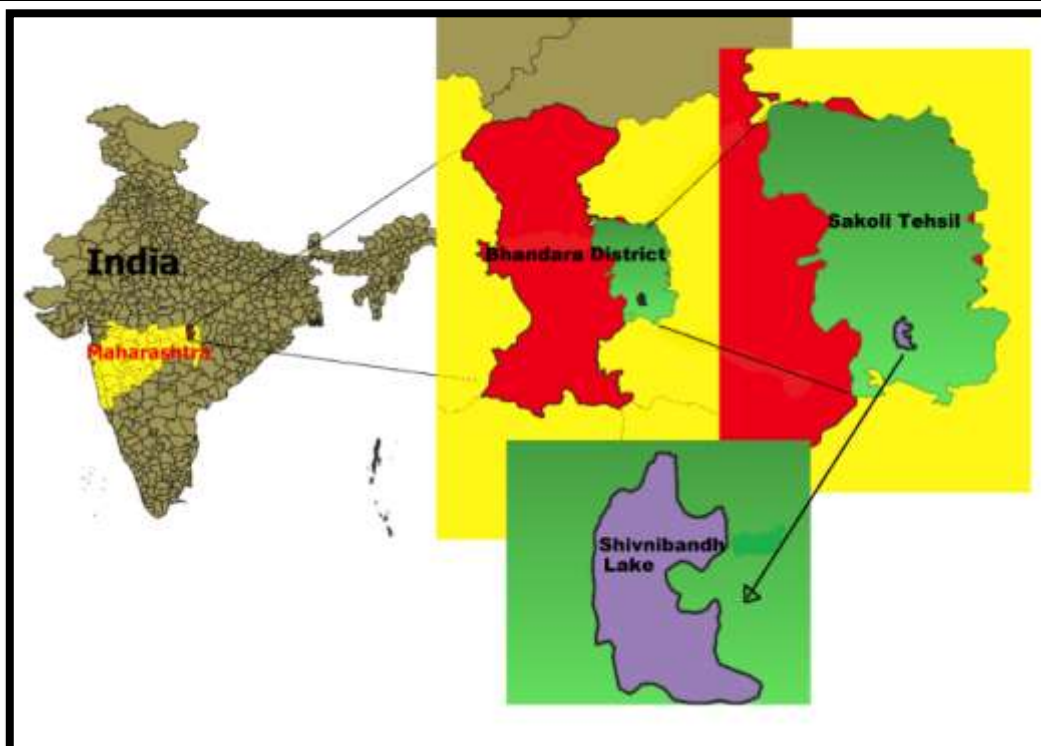


Fig:1 Study Area showing Shivnibandh Lake of Sakoli Tehsil of Bhandara district in Maharashtra state in India

### 2.3 NDWI Method of water body information extraction: -

The downloaded proceeds through data collection, Visual interpretation, NDWI Calculation, Reclassification, Masking is followed by Surface water extraction, accuracy assessment by field investigation were carried out. Images are analyzed by Normalized Difference Water Index (NDWI) and with the help of QGIS 3.2, Arc GIS 10.3, Google Earth software. etc. To extract the surface water bodies from remotely sensed data by calculating the difference between two image bands and applying an appropriate threshold on NDWI. It results into two categories: water and non-water [19].

The design of spectral band is based on the fact that water absorbs energy at near-infrared (NIR) and shortwave-infrared (SWIR) wavelengths out of 11 bands of Landsat Satellite data, only two bands have been used in this study[20]. It also enhances the level of accuracy of the result as well The NDWI value ranges from - 1 to +1. McFeeters set zero as the threshold like if NDWI is  $\geq 0$ , the area is considered as having occupied by water and if the NDWI is  $\leq 0$ . it would be non-water. It means, Vegetation and other features generally related to zero or negative values and is suppressed [19]–[21]

### 2.4 GIS and field Investigation: -

Geospatial Technology applicable to classify satellite images and categorized into two classes: water and non-water. Visual Interpretation of Satellite Image of study area is carried out by author. In the present research study, the QGIS and ArcGIS software were used for the processing of satellite data. To check the accuracy of the surface water bodies mapping with the help of Ground survey and repeated field investigation by noting observation and recording measurements was carried out by author (Fig:4). The Field data collection done with helps of Google Maps, Proforma sheet, Digital Camera ((NIKON D5200 with Zoom lens AF-S NIKKR 55-200), Binocular (OLYMPUS-10X50 DPS I), Mobile GPS (Redmi Note 8), etc. [22]. Furthermore, the correctly and incorrectly classified pixels were arranged in a frame to produce the error matrix and overall accuracy of classified images were analyzed.

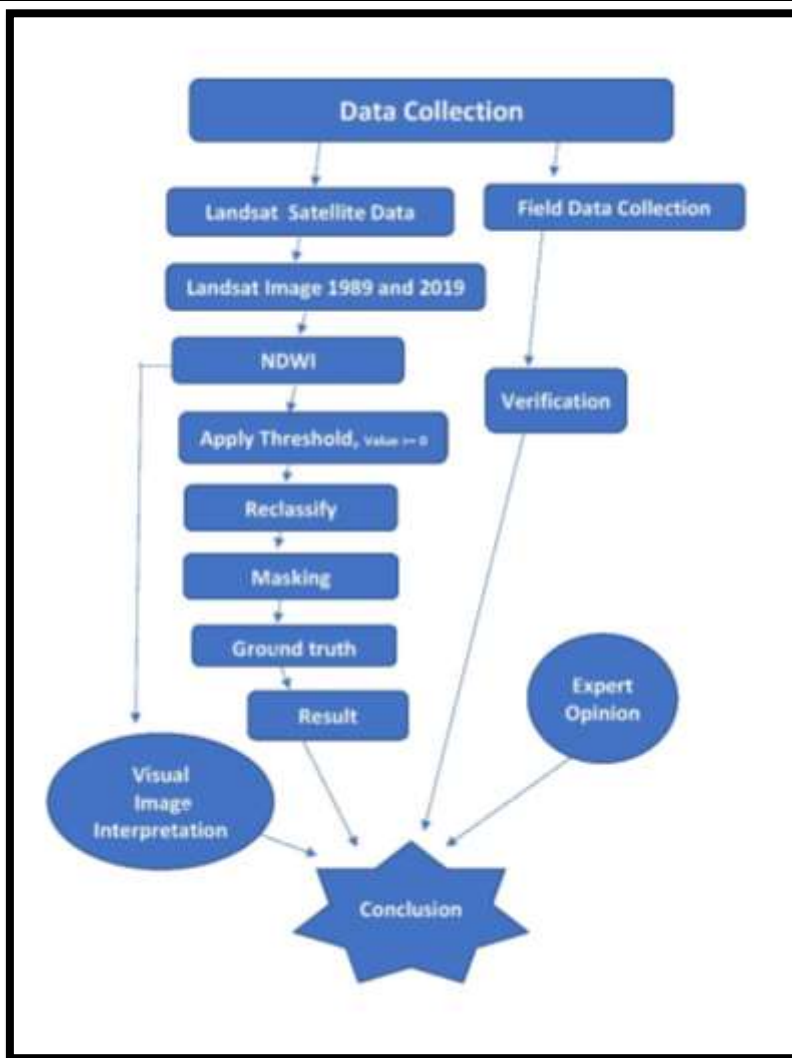


Fig 2: Methodology used for study

**III. RESULTS AND ANALYSIS: -**

**3.1 GIS based NDWI Result: -**

Shivnibandh Lake areas are subject to anthropogenic pressures, including transformation of catchment area into agricultural land, road construction, sedimentation into the wetland, and over exploitation of their natural resources. To separate the surface water using Geospatial technique from land and other features to mapping and assessment of the surface water correctly. NDWI based result shows that, during last three decades, surface area of water body of Shivnibandh Lake decreased from 304.65 Hectare to the 154.98 Hectare, which is suspected by NDWI based remote sensing and GIS technique in 1989 and 2019 respectively.

| Year | Surface area from NDWI (Ha) | Total Submerged Area (Ha) | % of loss of Submerge area |
|------|-----------------------------|---------------------------|----------------------------|
| 1989 | 304.65                      | 489.0                     | 37.83 %                    |
| 2019 | 154.98                      |                           | 68.30 %                    |

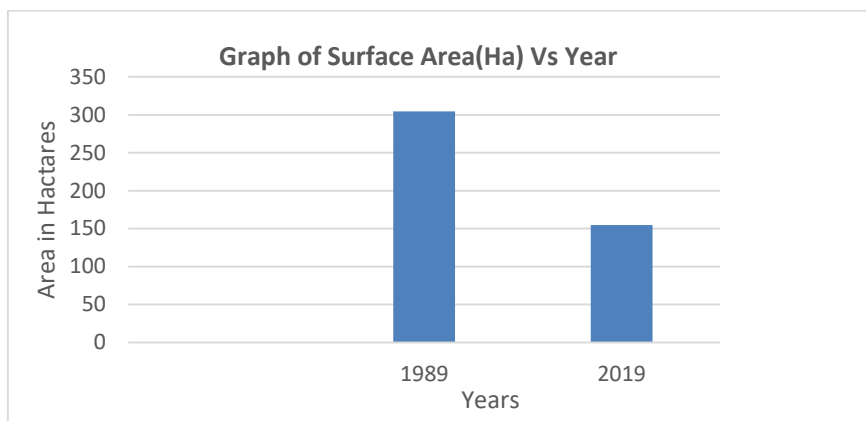
Table 1: Surface area changes with respect to years

**3.2 Identified Problem/Challenges at Study site: -**

- This wetland is suffered from encroachment for Agricultural practices in core and peripheral area and it is major issue at proposed site.
- Land acquisition by encroachment for Agricultural practices, construction of road in catchment area, cattle grazing, increase of invasive species, etc resulting into decrease in water holding capacity of wetland which causes sometimes flash flood at study site.
- Wetland dependency mainly for Irrigation of Agricultural practices, Fishing, Trapp cultivation, and its resource-based economy etc
- Shivnibandh lake not only contribute to the household economy of wetland depended group of people, but also become a vital source of livelihood for fishing communities too.

- During field visit at study site and discussion with local wetland dependent communities it is noticed that, local peoples are lack of awareness about wetlands resource as well as its potential values, its importance for livelihood of stakeholders and maintaining climatic sustainability too.
- Identified anthropogenic pressure study was conducted during field visit. Before some decade, the study area has more significantly rich aquatic flora and fauna. Therefore, the objective of this study is to assess and monitor of entire wetland status of shivnibandh lake in Sakoli Tehsil of Bhandara district in Maharashtra.

Due to significant decreased of occupied area along the villages by the communities is the disaster situation which collectively impacts livelihood of people, wetland potentiality, resources exploitation and loss of water parameter forever.



Graph1: Surface area changes with respect to years.

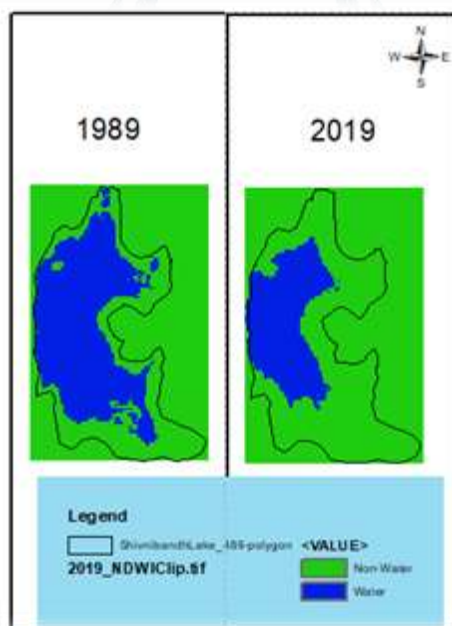


Fig 3: NDWI of 1989 and 2019 of Shivnibandh Lake of Sakoli Tehsil in Bhandara district of Maharashtra state, India

**IV. DISCUSSION AND CONCLUSIONS: -**

**4.1 Discussion: -**

Many of the wetlands in India supports the livelihood of thousands of people every day however, an increasing population and encroachment is a major problem with concerned issues. Anthropogenic pressure either directly or indirectly leads to degradation of the wetlands. The previous study of (V. P. Bawankule and L. P. Nagpurkar, 2021), Assessment & Monitoring of Surface Water in Wetlands of Sakoli Tehsil, suggested the overall water bodies, its water holding capacity of sakoli tehsil and areas are decreasing continuously. Therefore, authors intend to focused on Largest Lake in Sakoli Tehsil entire GIS study of Shivnibandh Lake by studied in this paper.

Remote sensing data using NDWI (Fig:3) in Spatiotemporal approach reveals that, during last three decades the surface water bodies of Shivnibandh Lake reduced to 154.98 Hectare from 304.65 Hectare, which is suspected by NDWI based remote sensing and GIS technique in 1989 and 2019 respectively (Table 1, Graph 1, Fig. 1). This entire study indicate that the existing situation of

wetlands is not satisfactory as far as surface water area is concerned. also clearly indicates by Visual Interpretation of Satellite image that, there is decrease in submerged area of Shivnibandh lake.

Therefore, we conducted several field visits in 2019 (Fig: 4), also we identified challenging issues associated with conservation and management of wetland. The management of the Shivnibandh Lake has received inadequate attention in State and National water sector agenda and still no significant progress has been made so far in conservation and Management practices and wise use of wetlands. Therefore, this study suggests an appropriate measure needs to be taken by the local administration and government to prevent further decline of the wetland surface water area.

Under the UN Sustainable Development Goals, The Govt. of India and Govt. of Maharashtra had Taken many important steps to further strengthen the conservation, protection and Management of rich diversity in India, which including planed programme, action planes, policies, and legal framework as well as awareness among local people about wise use natural resources but, still less efforts have been made towards the implementation of the same. If such degradation rate of water bodies would be continued, the existing area would be severely put towards decline, it will have disasters impact on aquatic flora and fauna too. Also, it causes not only massive damage to the aquatic ecosystem but also huge loss of entire biodiversity.

#### 4.2 Conclusion and recommendations: -

The conclusion of this study is that the Shivnibandh Lake is facing severe problems due to anthropogenic pressure. Most of the nearby communities are dependent on wetland resources for their daily livelihoods and they are willing to conserve it in cooperation with the local administration people participation. Therefore, an inclusive and collaborative approach should be initiated to conserve this important wetland, without any compromising the interests of local peoples with the following **recommendations**:

- The inlet channel of the wetland should be cleaned to allow flowing rain water from forest, hills, etc by barrage to maintain the perineal source water for the maximum time.
- An immediate weed removal program should be undertaken in participative manner.
- A clear-cut boundary demarcation should be made for the Shivnibandh Lake by local the administration.
- Illegal land acquisition, agriculture, land digging, waste disposal, and bird trapping in the wetland should be should be strictly prohibited.
- Conflicts among different sections of society for the utilization of the Shivnibandh Lake resources should be resolved.
- Awareness programs by NGO or Governmental level should be initiated to make people aware of the socio-economic importance and value addition of wetlands in society.
- Eco-tourism should be promoted to provide alternative livelihood options for local people.
- The sustainable use of water resources should be practice and it should be the part of conservation policy.

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Fig: 4 (A)- Encroachment for Agricultural practices in submerged area is major issue at study site, (B)- Field visit at south-eastern site of study area, (C)- Construction of road in catchment area, (D)- To eradicate weeds like Besharam (*Ipomoea cornea*) is also big challenge at study site, (E)- Visited at Encroachment site southern direction inside Shivnibandh Lake. (F)- Field Visit at Northern site of Shivnibandh Lake

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