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Impact on Ecological, Economical And Environmental Ecosystem By The Wetland Part of Religious Ponds of Ratanpur In Chhattisgarh, India, A Survey

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Abstract *- Wetlands are the places where water in abundance governs the kinds and life of organisms. Such habitats, also called Sarovar, taal, jheel, etc., or lake, pond, marsh, and swamp, laid the foundation of human civilizations and were an integral part of our socio-cultural ethos. Construction of such habitats to meet the water needs during dry periods of the year was considered to be 'Raj Dharma'. During British rule, these habitats with no value for the revenue were declared as 'wastelands'. Their values were rediscovered in Europe and North America, first for the migratory waterbirds and later for other benefits. To ensure their conservation worldwide, an international convention, the Ramsar Convention, was agreed upon on 2 February 1971 (in Ramsar, Iran). This day is now observed as World Wetland Day. Now wetlands are shrinking rapidly because of urbanization and industrialization. The physical and chemical characters of the water of the wetlands can be used to assess the ecological nature of the wetlands. Ratanpur town is popular as 'Temple City' as well as 'City of Ponds'. 05 selected healthy and ecologically important wetlands name Dulahra, Ved, Ratneshwer, Bikam, and Aathabisa ponds were surveyed in Ratanpur in Bilaspur District of Chhattisgarh period of August 2018 to December 2019. Water samples were collected from various sampling sites from different water reservoirs– Dulahara pond, Bikam, Ved Ratneshwer, and Aathabisa pond/wetland. Sampling sites were selected on the basis of the margin length of water reservoirs at an interval of 100 -150 meters (approx.) and 40-60 meters inside the ponds. Considering the depth, the samples were collected from the water surface & bottom of the ponds. Ecologically it is an important wetland providing habitat to migratory and local bird species. Dense vegetation and a pollution-free environment in wetlands have attracted a large number of birds in the winter season. Wetlands act as natural water purifiers, filtering sediment and absorbing many pollutants in surface waters. In some wetland systems, this cleansing function also enhances the quality of groundwater supplies.*
Wetlands act as natural water purifiers, filtering sediment and absorbing many pollutants in surface waters. In some wetland systems, this cleansing function also enhances the quality of groundwater supplies. Wetland reduces downstream flood damage. Wetlands provide habitat for many species of amphibians, reptiles, birds, and mammals that are uniquely adapted to aquatic environments. Upland wildlife like deer, elk, and bears commonly use wetlands for food and shelter. Wetlands are particularly vital to many migratory bird species. For example, wood ducks, mallards, and sandhill cranes winter in flooded.

Keyword - *Wetlands, natural water purifiers, urbanization, Industrialization*

I. INTRODUCTION OF WETLAND

When an area of land is saturated with water either permanently or seasonally, then water will be converted into a big dry land, mostly in the summer season .it is called a wetland. Wetland may be natural or manmade. They provide habitat for animals and plants, and many contain a wide diversity of life [1]. Wetlands are areas where water is the primary factor controlling the environment and the associated plant and animal life. Wetlands are known as earth kidneys because kidneys play an important role in filtering water. As water moves through a wetland, the sediments and pollutants stick in the wetland, making water cleaner. It can reduce flooding and protect our shores from wave action, absorb pollutants and improve water quality. Wetlands reduce the impact of floods by acting as storage areas [2].
Stored water percolates downward, getting purified in the process, and replenishes the groundwater. It is interesting to note that wetlands cover a tiny portion of the earth's surface, but by the nature of their unique ecosystem, it becomes all the more important to protect and conserve them. Wetlands are important components of watersheds and provide many valuable functions to the environment and to society[3]. Now wetlands are shrinking rapidly because of urbanization and industrialization. The physical and chemical characters of the water of the wetlands can be used to assess the ecological nature of the wetlands. A wetland is an environment at the interface between truly terrestrial ecosystems and aquatic systems, making them

inherently different from each other or yet dependent on both. Aquatic and wetlands plants are mostly confined to the marshes and wetland habitats [4]

Ratanpur town is popular as a religious center, and many Hindu devotees come here to offer their prayers and seek blessings at the Mahamaya Temple; Goddess Mahamaya, also known as Kosaleswari, as she was presiding deity of Dakshin Kosal (modern Chhattisgarh). Many other temples such as Bhudha Mahadev, Hanuman Garhi, and Ramtekri are also situated there. Perhaps due to various temples of different era/periods and other religious purposes, so many small and large ponds/ tanks are available. That is why the Ratanpur Nagar is popularly known as **'Temple City'** as well as **'City of Ponds'.** There are more than a hundred temples, most of them are disreputable, and some are renovated/maintained by State government and Trust concerned, while only two temples are catered & conserved by Indian Archaeological Department, Govt. of India. Retrospectively temples correlate with more than a hundred small & large ponds. However, more than 150 Ponds existed during the ancient period, as cited in history. Out of these ponds, Dulhara, Bikma, Aathabisa, Ved, Ratneshwar Girjaban, and Krishnajuni are large ponds, respectively. Nowadays, some areas of the largest pond, such as Dulahra and Bikma pond, have been converted into wetland, and the whole part of the Aathabisa pond is almost converted into wetland and completely dry in the summer season.

II. BACKGROUND OF STUDY AREA

A thorough survey of the water reservoir (wetland) in the entire area of Ratanpur Nagar has been performed. It is a well-known fact that **Ratanpur** is a Nagar Palika in Bilaspur district in the Indian state of Chhattisgarh, situated at 22.3^0N and 82.17^0E, having average rainfall varies from 135mm to 445mm and humidity 34 percent. It is located about 25 kilometers (16 miles) from Bilaspur on National Highway 200 towards Ambikapur. (Fig. 1, location map).

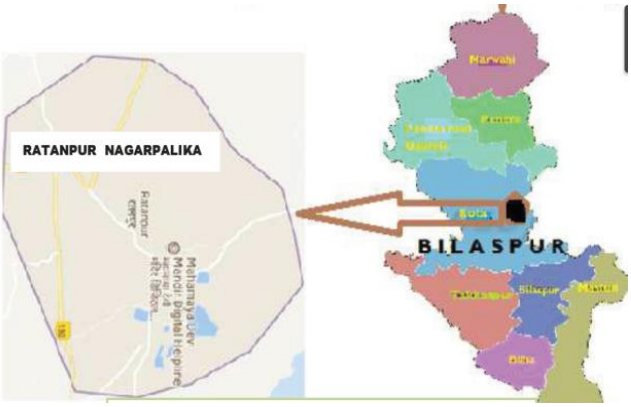

Fig.1 Map Showing the location of Ratanpur in Chhattisgarh Map

The entire area of Ratanpur Nagar Palika has been divided into four zones (A, B, C & D) which comprise major and minor ponds, as shown in Fig. 2 and mentioned. 05 selected healthy and ecologically important wetlands name Dulahra, Ved, Ratneshwer, Bikam, and Aathabisa ponds were surveyed in Ratanpur in Bilaspur District of Chhattisgarh period of August 2018 to December 2019. Water samples were collected from various sampling sites from different water reservoirs– Dulahara pond, Bikam, Ved Ratneshwer, and Aathabisa pond/wetland. Sampling sites were selected on the basis of the margin length of water reservoirs at an interval of 100 -150 meters (approx.) and 40-60 meters inside the ponds. Considering the depth, the samples were collected from the water surface & bottom of the ponds.

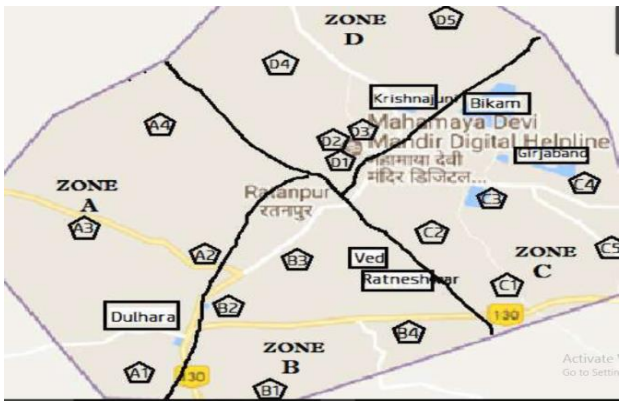

Fig.2 Map of Ratanpur Nagar area showing study zones

A. Zone – A: This zone of Study area comprises several ponds, including a very large pond, popularly known as Dulhara. Within the present study area, Dulhara is one of the largest wetland ponds (180acre land area), having vast historical importance linked with a deep sense of the religious sentiment of regional people. Its name also has a special meaning that two types of the wave were observed by Sage Mahatma and advocated as the union of Ganga & Yamuna. During the ancient period, this pond was significant to serve the local people by economic, social, and religious value. In present-day also, this pond is

important to fulfill the needs of society in almost various aspect of life providing irrigation water, facility for domestic & daily work and economic aid through large production of fishes, lotus stems (dhens), lotus leaves, lotus flowers, motha grass, etc. Besides this large pond, there are so many small water reservoirs.

Fig. 3 Dulahra pond in different Direction

B. Zone – B: This zone of Study area comprises several ponds, including two large ponds adjacent to each other's, popularly known as 'Ved and Ratneshwer'. Within the present study area, Ved and Ratneshwar are also well known as the largest pond or wetland (approximately 60 and 70-acre land area respectively), having vast historical importance linked with a deep sense of the religious sentiment of regional people. Ratneshwer Mahadev Temple was built by Ratnadeva-I at the bank of the pond, so-called Ratneshwar pond; next to the Ved-Ratneshwar lake is a 400-year old Kabir ashram which was built by Sudarshan, a follower of Sant Kabir. In spite of close vicinity, both ponds are quite different in their nature.

Having more depth vertically, Ved pond captures the entire domestic sewages of the adjacent village, and the watercolor is blue-green completely avoided aquatic vegetation; however, significant for local population providing water for bathing and other domestic work with economic aid by the large production of fishes. Due to improper drainage systems, septic tanks, and solid waste disposal, contamination of groundwater by organic chemicals and micro-organisms is likely to occur. Similarly, contamination due to inorganic chemicals from seepage of effluents from industries is also possible. The pond is anthropogenic, and its water is used for domestic purposes and irrigation. The pond is surrounded by semi-urban and semi-agricultural areas. Located within the beautiful scenario and holding the ancient temple of Ratneshwar Mahadev, the Ratneshwar pound seems to be a site of holy & cultural/religious worship feelings of concerned villagers, especially the festivals celebrated by local women representing the rich traditional value of local people of Chhattisgarh. The Swayambhu Mahadev temple gives strength to local people performing ''Tarpan'' rituals in the memories of their beloved ancestors indicate the moral values of local society. With economic value also, this pond is significant, providing water for bathing, cooking, other domestic work, and large production of fish.

Fig. 4 Ved Pond in Ratanpur

Fig. 5 On one side (left) of the road is Ved Pond and on the right is Ratneshwer Pond

Fig. 6 Wetland part of Ratneshwer pond

C. Zone – C: This zone of Study area comprises several ponds, including two large ponds closely situated to each other's, popularly known as „Bikam' and 'Girjaban' located nearby Ram- Tekary with the beautiful scenario. Within the present study area, Bikam is also popular as one of the largest pond /wetlands covering a 140-acre land area rather than Girjaband pond with a 40-acre land area approximately. Having historical importance and linkage of religious sentiment, these ponds are of environmental, social, and economic significance for regional people.

Bikam pond is used to support the daily life of the local public with their domestic animal. The catchment area has been reduced by water hyacinth and wild weeds, especially after boundary wall construction due to the reduction of water collection for storage during the rainy season. With economic value also, this pond is significant, providing water for bathing, cooking, other domestic work, and large production of fish. The Girjaband pond, situated aside from the famous temple Hanuman Gadhi, is also significant to the adjacent population and religious visitors.

Fig. 7 Wetland area of Bikam Pond

***D. Zone – D*:** This zone of Study area comprises several ponds, including a very large pond, popularly known as 'Krishnajuni'. Within the present study area, Krishnajuniis one of the largest pond/wetlands (65-acre land area), having historical importance and significance to serve the local people by economical, social, and religious value since the ancient period. In present-day also, this pond is important to fulfill the needs of society in almost various aspect of life providing irrigation water, facility for domestic & daily work and economic aid through large production of fishes, lotus stems (dhens), lotus leaves, lotus flowers, motha grass, etc.

Fig. 8 wetland part of krishnarjuni pond

Fig. 9 Athabisa wetland

III. OBJECTIVES OF STUDY OF WET LAND OF RATANPUR

The present research survey was proposed to aim and important objectives of the study the wetlands of Ratanpur in Bilaspur district of Chhattisgarh state with following

1. Survey of the water reservoir in an urban and rural area of Ratanpur Nagar Palika
2. Analysis of Physical and Chemical parameters of the water samples collected from the entire sampling
3 Wetland areas and Characterization
4 Survey of public health in local settlements utilizing such water by different means
5. Floristic study of polluted water bodies/reservoirs and adjoining agriculture and residential area.
6 Conduction of „Public Awareness Program" under outreach activity.
7. Providing the reports to concerned organizations for proper treatment of disposals to control the water pollution in this state.

IV. CLIMATE AND RAINFALL IN WETLAND AREA OF RATANPUR

The climate of the district is of tropical type. Summer is hotter. The rise of temperature begins from the month of March to May. May is the hottest amongst others. The annual average rainfall is 1052mm. During the year, most rainfall occurs during the monsoon month June to September. July is the month with the highest rainfall.

The region is endowed with a sub-tropical monsoon climate with three distinct seasons, i.e., summer, monsoon, and winter. The southwest monsoon starts from June and continues till the middle of September. The Winter season spreads from October to February. The summer season extends from March to the middle of June. Rainfall is the major source of groundwater recharge in the area and receives maximum (85%) rainfall during the southwest monsoon season. The winter rainfall is meagre (10 - 15%). The Indian Meteorological Department (IMD), various State Government departments, Agricultural Universities, etc., are maintaining a number of rain gauge stations which comes to more than 200 in the State.

A. Migrating Birds Around The Largest Wetland

Birds are being counted following a wide variety of methods. For waterbirds, the direct counting method was used. In this method, a suitable vantage point is selected, and all visible birds are counted. Birds were systematically conducted from morning 6:30hrs to 10:00hrs and using Canon camera and birds were identified as well as captured.

Bird watching and recording have been carried out in regular intervals during summer, rainy, and winter seasons of the year in order to cover migratory and resident species. Bird survey was conducted by using the distance sampling point count method to observe the avian diversity distribution in all the selected wetlands for consecutive years (2018-2019) Distance-sampling point count method is an easier and more efficient method to perform bird's surveys[5]. Bird survey was conducted when birds are most active during the day from 06:30 to 10:00 am and from 5:30 to 7:00 pm. Field visits have been conducted twice a week for all three seasons, and field characteristics were noted down on ornithological datasheets. During the study, we observed that the maximum number of birds were recorded from Dulahra and Ratneshwer wetland parts, whereas the Ved and Bikam ponds were observed with a very less number of wetland birds.

V. IMPACT ON CULTIVATION

The area is a human-managed wetland of Ratanpur where lotus is grown in Dulahra pond and managed as a crop. Relatively shallow and permanently flooded wetlands are preferred for cultivating lotus because of their higher monetary returns. Ratanpur community people of the district are usually wetland condition in about 180 acres area of Dulahra pond and 140 acres of Bikam pond in Ratanpur Nagar Palika which is considered as waste, unused for paddy and vegetable cultivation involved in its cultivation.

The people of this community are mainly involved in fishing, and they are habitual to work under waterlogged conditions for 4-5hrs per day. They come to know the economic importance of Lotus rhizome, but under pond conditions, the digging of Rhizome is not possible under Rainy and winter conditions due to high water level under pond conditions, although the market price is very high, up to Rs.120-150 /Kg.

VI. SOCIO-ECONOMIC AND ENVIRONMENTAL IMPACT

Lotus has many other uses apart from its rhizome for its vegetable purpose. Being sacred, the flower is offered to God and Goddess in temples during religious festivals. The buds are used for making floral arrangements, and the dried torus is used in floral decoration. Various parts of the lotus plant are edible and are said to rejuvenate the human body.

Environmentally growing Lotus is very safer because it can tolerate acidic and alkaline water in the pond. In some research, it is proved that lotus can absorb heavy metals and may be recommended for plantation in the ponds used for discharging the industrial waste for water purification in most natural manner scientific cultivation and harvesting can definitely enhance the productivity and hence can generate more income. The restoration of wetland and their resources and their biodiversity for future, the research and information exchange can conserve activities through joint and effective research orient program with the participation of local community especially fishing community who are involved in Lotus cultivation.

Like other parts of India, Multi-use common water bodies constitute an important component of community assets in Ratanpur, like another part of India that have been used as traditional commons by local communities to meet their domestic needs and practices fish & lotus farming in this wetland complex. Fishes like Kofia, Magur, Jhori, Chital, Rohu, Gaunchi, Punti, Katala, and Tengna are commonly found in these ponds.

Dulahara pond is the biggest wetland in Ratanpur and has the most important economic value. The pond water is used for irrigation purposes, fish farming & trading as a production ground for lotus flowers which are in great demand as it is a city of temples. The Dhens (Lotus stem) is a second economic product of Dulahara, and Fish cultivation is a regular activity in the Dulahara tank and Bikam pond. Dulahara wetland complex is a good source of revenue to the government besides the use of the local public for domestic activities and agriculture practices.

Fig. 10 Fish Cultivation

VII. QUALITY OF POND WATER

Water quality conditions in a pond are controlled by both natural processes and human influences. Natural factors such as the source of the pond water and the types of rock and soil in the pond watershed will influence some water quality characteristics. These factors are difficult to control but usually cause few problems. Instead, most serious water quality problems originate from land uses or other activities near or in the pond. The effects of these activities can often be minimized through proper management and early detection of problems through testing.

VIII. HYDROLOGICAL INFLUENCE

Hydrology is the scientific study of the movement, distribution, and quality of water on Earth and other planets, including the water cycle, water resources, and environmental watershed sustainability. Water quality and quantity were found the variable based on the size of the water reservoir, its utilization/application for society and management, water recharging system/situation, and their hydrological relation. Based on the hydrological relationship, ponds between Bikam and unidentified wetland (like ditches) have been included in the Dulhara wetland complex. Whereas Dulahara is a big reservoir of 154 – 180 Acre area, however, the present status of the water area is different.

IX. STATUS OF WATER QUALITY

Following the standard laboratory methods (APHA, 1992, 1998) and using sophisticated equipment & graded chemicals, water samples were analyzed for different parameters like Electric Conductivity, Total Dissolved Solids, TSS, Dissolved Oxygen, Alkalinity, BOD, Nitrate, Phosphate, Ca & Mg ion and Transparency.

Observed data about the Physico-chemical analysis of water samples collected during three seasons - Rainy (Up to October), winter (Up to February), and summer (up to June) have been studied. Seasonal, as well as site wise variation in physic-chemical characteristics of water samples, have been observed that correlates adjacent water reservoirs. Most of the sites of Dulahara pond exhibit a rise in pH during the winter season as compared to the rainy season; the pH shifts towards slight alkaline during winter. The seasonal shift in pH still recorded is within WHO limit except in water samples of south direction, which is due to heavy anthropological activities. The slight decrease in pH shows a relation with the decrease in DO of the water samples. Rainwater during the season had an overall diluting effect on TSS as values increase during winter. None of the sites have higher TSS crossing the WHO limit. Phosphates are high above the WHO limit and show an increase in summer except in the east & south direction. The increase in phosphates indicates a relationship with a fast decrease in the water content as rains recede. The overall seasonal effect is notable in decreased during the season due to a slight fall of pH, decreased DO, and increased BOD.

Water is more transparent in the south direction compared to the other directions in the Dulahra pond. High turbidity appears in the north and west direction, but in the east direction, the water level becomes down (almost dry) during the summer season. Bikam pond water was slightly acidic when compared with Dulhara pond water. Highly acidic or highly alkaline waters are undesirable because of corrosion problems and the formation of toxic trihalomethanes. But the Dulahara pond water is more transparent than the Bikam pond. The EC and TDS of Bikam water were more than that of Duhalara, which indicates that water was not suitable for domestic purposes**.** The portability of water depends on the dissolved solids. Dissolved solids are various kinds of minerals present in water. However, if some organic substances are also present, as more often in polluted waters, they may also contribute to the dissolved solids.

In the present study, the value of DO in the Dulhara pond is less than that of the other ponds cause to be the presence of small plants and microphytes in the vicinity of the pond, which absorbs oxygen dissolved in water. Similarly, the BOD in the Bikam pond water and ditches water is slightly more than the Dulhara pond

In these water samples, the concentration of nitrates and phosphates increases with increases in depth at inner sites during the summer season. Alkalinity also increases with another common feature of the three ponds is that both EC and TDS increase at the marginal sites during the winter season compared to the rainy.

The cultivation of Lotus and fishes are maintaining the balance of pond water that is due to the level of dissolved oxygen in the pond. Although the phosphates are at a higher level and the microbiological quality of water is unsafe, the pond has not indicated eutrophication but is on the verge of it as indicated by slightly high DO, PO_4, increased microbial load, and higher BOD values. Athabisa pond dries and is completely converted to the wetland in the summer season. So no records were found during the summer season.

X. BACTERIOLOGICAL EXAMINATION

The bacteriological analysis of water samples of the Dulahara wetland area reveals that the pond water is not safe for human society, cattle as well as aquatic fauna. As per WHO, any incidence of fecal coli-forms in water renders it unsafe for drinking. All sampling sites indicate the presence of fecal coli-forms and heavy load in the water. The presence of fecal coli-forms, their highest count, is indicative of anthropogenic activities. The high level of phosphates supports the total bacterial count in the pond water. A more or less similar situation has been observed in the Bikam pond. Being a center for cattle washing and domestic activities, the fecal coli-forms and total bacterial count is very high in Ratneshwer pond.

XI. FLORISTIC & ECOLOGICAL STUDY

A floristic and ecological study of aquatic & semi-aquatic macrophytes / angiospermic flora was carried in these water reservoirs. During which the plants were observed carefully, fresh specimens of plants with or without flowering & fruiting conditions were collected, brought in the laboratory in polythene carry bags, dissected, and identified with the available keys.

A total number of 27 aquatic and semi-aquatic species were found from the Dulahara pond belonging to 22 families and 23 genera. Out of these, 13 families belong to dicot having 14 genus and 15 species, whereas 09 families belong to monocot having 09 genus and 12 species. Out of which Nelumbo, Nymphea, Hydrilla, Lippia, Ludwigia, Eichhornia, Ipomea, and Cyprus were dominant in the Dulahara pond is famous for Nelumbo plant (Indian lotus) since the ancient period. Simultaneously total number of 19 aquatic and semi-aquatic species was found from the Bikam wetland belonging to 16 families and 17 genera. Out of which Eichhornia, Pistia, Hydrilla, Ipomea, Lippia, and Cyprus were dominant, a total number of 20 aquatic and semi-aquatic species were found from the Ratneshwer wetland area belonging to 14 families and 18 genera.

Plants can effectively be used as cheap and naturally available monitoring systems or bioassays of the level and type of air, soil, and water pollution in an area. The type and concentration of a pollutant can be reliably found out by various characteristics damage symptoms produced in the plants because such damage symptoms are pollutant specific as well as concentration-specific. Though all types of sensitive species can be used in monitoring pollution, mosses, lichens, ferns, algae, and aquatic plants are generally more useful in pollution monitoring because their range of pollutant specificity is usually much higher than that of higher vascular plants. Specific changes in the aquatic flora can indicate the pH of the water quite correctly. Decrease in the densities of sensitive species, increase in the density of tolerant species, absence of highly sensitive species, changes in the species composition of vegetation and distribution pattern of populations in the area indicate the type and concentration of pollutant(s) as well as the spread of the pollution problem in the area.

The occurrence of more tolerant species of angiosperm like Eichhornia, Hydrilla, Cyprus, Ipomea, Pistia, Monocharia, Aponogetum, and Celosia indicate the water pollution of this wetland complex. The abundance of Eichhornia indicates sewage and heavy metal pollution of water, and densely presence of Hydrilla plant expressed more alkalinity of pond water. Hydrilla species have a high resistance to salinity compared to many other freshwater-associated aquatic plants and allelopathic in nature. More than the limit presence of Calcium and Phosphate in pond water is indicated by the presence of species of Cyprus, Aponogeton, and Hydrilla.

XII. DISCUSSION PART

Wetlands are an important pool of aquatic life (Plants and Animals). Wetlands are among the most productive ecosystems in the world that provide habitat for large numbers of flora and fauna. Now, attention has been curved to using the wetland systems and the plant species occurring in there as bio-energy sources and also for use in pollution abatement projects to filter sewage, agricultural run-off, leachate from landfills, and acid mine drainage mitigation [7] A wetland is an environment at the interface between truly terrestrial ecosystems and aquatic systems making them inherently different from each other or yet dependent on both. Aquatic and wetlands plants are mostly confined to the marshes and wetland habitats. In the present study, 88 species were recorded, out of which 36 were fully dependent on wetlands. The diversity of angiosperm flora in different water reservoirs shows the nutrient level of such an aquatic ecosystem. However, the densely occurrence of more tolerant and resistant flora gives the cue of pond water pollution. Comparative observation of the occurrence of macrophytes reveals that the water of Dulahara is more polluted than Bikam pond and the Ratneshwer wetland area has very less polluted water.

The level of pollutants in this pond is significantly lower in comparison with any other ponds under investigation. This suggests that the water of this pond should be treated so that it can be used for domestic purposes as well as for irrigation. The extreme softness of Dulahra pond water is due to low Ca and Mg values. The water, when touched, is of a considerably soft nature, almost similar to ordinary soaps. The population within the pond uses the water for

washing clothes and themselves. A perusal of the table shows that a correlation exists between EC and TDS due to Electrical-conductivity - depends directly on the number of salts dissolved in water and the content of two valence ions.

The Dulahra pond water quality parameters are well within the prescribed levels and are suitable for fisheries and other domestic human activities. Seasonal changes in the environment were observed, but these were however not statistically significant. Regular monitoring of pond water and applying appropriate corrective actions such as immersion of statues should be stopped, recycling of the pond water, discharging of treated water in the pond. This will help in improving the water quality of the pond.

The level of pollutants in Dulahra and Ratneshwer ponds is significantly lower in comparison with other ponds under investigation. This suggests that the water of this pond should be treated so that it can be used for domestic purposes as well as for irrigation.

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