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POLLUTION AND WATER QUALITY STATUS OF WETLANDS AT DISTRICT MAINPURI (U.P.), INDIA

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ABSTRACT
Wetlands and agriculture fields of district Mainpuri contribute to the healthy population of Sarus and other wetland birds. A large number of wetlands are situated in Mainpuri and many others emerge in Monsoon season. In winter season (from the month of October to march) a large number of birds of different species can be seen around these wetlands. Due to less urbanization; Mainpuri is favorite place of local and migratory birds. Markandeshwar (Site-I), Bhamwat Canal (Site-II), Saman (Site-III), Sauj (Site-IV) and Krithua (Site-V) are the name of major wetlands in Mainpuri, which are selected for the present study. BNHS and Bird life International has designated Saman bird sanctuary (Site-III) and Sauj (Site-IV) as IBAs (Important bird areas), under IBAs programme. The physicochemical parameters play a vital role in the wetland ecosystems. A significant variation in these parameters was observed throughout the study period; between April 2011 to February 2012. In this paper, hardness and coliform of water from these wetlands have been discussed. This review also deals with the status, causes, threats to wetlands and consequences of wetland losses, their planning, legislation and some approaches and techniques for pollution prevention.

KEYWORDS: physicochemical, wetland, environmental, planning, pollution *etc*.

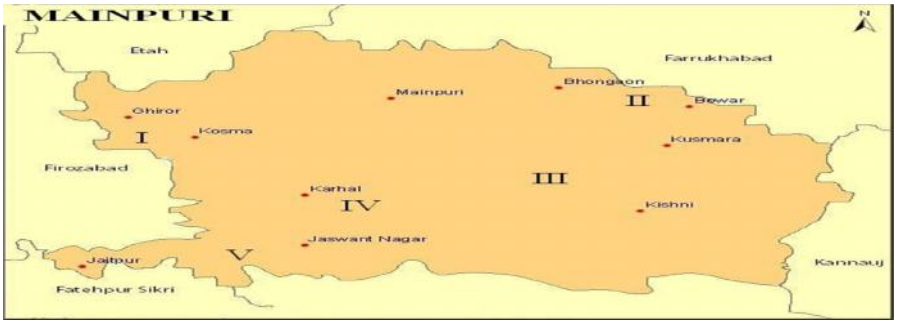
INTRODUCTION

The wetland's ecological diversity depends on the crucial balance of complexly interactive forces of physical, chemical and biological processes (Bhattacharya, 1994). Being highly productive and having genetically diversified ecosystems, the wetland provides important benefits of both goods and services. The wetland provides important values of biological diversities in terms of both floral and faunal assemblages, cultural and historic values to be designated as a heritage site, aesthetic values in form of its excellence in natural beauty, variable landscapes and habitat types and a large number of attractive wildlife. (Chakrabarti,1991). Moreover, the wetland serves several functions like nutrient retention through persistent vegetation, restricted circulation through winding channels and creeks, seasonal flooding and high sediment organic content, nutrient recycling with a high rate of primary productivity, with significant areas of submerged vegetation that dies seasonally; groundwater recharging through the permeable substrates, controlling biogeochemical cycles, the major source and sink of carbon and breeding ground of waterfowls and other aquatic organisms. (Selvam, 2003). Wetlands are also effective in processing nitrates (Cooke *et al*., 2005). They have the capacity to remove various pathogens from water passing through. Although this is true of many wetlands when pathogens (*e.g.* coliform bacteria) are present in high loads, it should be noted that wetlands themselves include active populations of many bacteria. Wetlands with large populations of birds or other wildlife may well contribute more fecal bacteria to through-flowing water than they remove (Kadlec and Knight, 1996).

MATERIAL & METHODS

Geographical location of study site

Mainpuri, a District of Agra, U.P., India, is bounded on the north by Etah District, on the East by District Farrukhabad and Kannauj on the South by District Etawah and on West by District Firozabad. It lies between north latitude 26º 53' to 27º 31' and East Longitude 78º 27' to 79º 26'. The area of the Distt. is 2745 Sq. km and population 13, 11, 492 in 2001.Out of 1,228 bird species found in India (I.U.C.N.); Uttar Pradesh has 25-30% of birds species out of total species found in India, and of all Sarus counted in U. P. were 73.04 percent encountered in the districts of Mainpuri, Etawah, Etah, and Aligarh. (Plate-I).



I - Markandeshwar
II - Bhamwat Canal
III - Saman
IV - Sauj
V - Krithua

Plate I –Map showing different sites of Mainpuri

Study area

Markandeshwar (Site-I), Bhamwat Canal (Site-II), Saman (Site-III), Sauj (Site-IV) and Kirithua (Site-V) are the major wetlands in Mainpuri, which were selected for the present study. BNHS and Bird life International has designated Saman bird sanctuary (Site-III) and Sauj (Site-IV) as IBAs (Important bird areas), under IBAs programme.

Analysis of water samples

For the analysis of water, samples were collected at random basis from each site, in plastic bottles previously cleaned with distilled water. The water samples were collected at seasonal intervals from five wetlands to conduct physico chemical study. The methods of analysis was in accordance to *(Eatson AD, Clesceri, L.S.& Greenberg, AE Eds) 20th ed. Ameri. Pub. Hlth. Assoc.*, Washington D.C. APHA, AWWA & WEF (1998).

Hardness

Hardness of water was determined in lab by titration method (EDTA), in lab.

$$Hardness \text{ as mg/l } CaCO_3 = \frac{\text{ml EDTA used} \times 1000}{ml \text{ of the sample}}$$

Faecal Coliform count

Water samples were brought to the lab and tests were conducted for Faecal coliform count determination. The coliform was determined in accordance with standard methods for the examination of water and Wastewater'. It consists of three stages, each of which necessitates a positive result for the previous stage. The first stage (the presumptive test) determines the gas-producing coliform characteristic during lactose-fermentation. The second stage (the confirmed test), determines the gram-reaction and also the lactose fermentation abilities of the organism, while the last stage (the completed test) determines the endospore presence to determine if the organisms in the sample indeed are coliforms. The number of coliforms or bacteria present is readily seen with the use of a special table and then the statistically estimated numbers are determined.

Statistical analysis

Data were analyzed by one-way analysis of variance (ANOVA). Significant difference among groups was determined by Tuckeys tests. Data are presented as mean ± Sem. The values of $p<0.05$ were considered significantly different.

RESULTS &DISCUSSION

Causes of wetland Pollution & degradation of water quality

Alteration in the hydrology can change the character, functions, values and the appearance of wetlands at Mainpuri. Water quality is directly proportional to human population and its various activities (Chopra, 1985). The major polluting factors are sewage, cottage industries and agricultural runoff, which may contain pesticides, fertilizers and herbicides. Solids and colloidal materials from overburden are often responsible for increased sedimentation in the adjacent water bodies. Draining of wetlands has depleted the ground water recharge.

Pollution resulting from use of pesticides

Pesticides pose environmental pollution problems when they are discharged into the environment, because they are poisonous to many non-target species at Mainpuri. Some pesticides remain active for long periods or may break down into more toxic compounds. These, together with the residues of pesticides already applied to fields and buildings, pose a danger to human health and the environment. Other sources of pesticide pollution stem from poor storage and transportation and inadequate management of manufacturing and formulating plants. Lack of awareness of the dangers linked to the handling of pesticides further complicates the problem. Water is the main receiver of pesticide pollutants. Approximately 50% of the pesticide sprayed onto a crop falls on the ground or is carried away by wind and enters the water table via rain or irrigation waters. Some pesticides eventually contaminate drinking water. Expired pesticides also find their way into the soil and water bodies.

Oil pollution

Pollution of water bodies with oil is becoming a major problem, especially in the urban areas. Wherever oil is used and handled, such as in garages and workshops, the ground at the site and nearby ponds, trenches or ditches is impregnated with oil through discharge of oily wastes or accidental spills. Car washing businesses are often sited near water bodies, leaving waters covered with layers of oil. At the ports, large quantities of oil are handled and there is a chance of large scale oil spills from ships.

coliform

Every year outbreaks of water-related diseases, such as cholera and diarrhoea are reported. Most serious is the contamination of drinking water sources with pollutants and bacteria. One of the main sources of water pollution in wetlands is domestic and institutional wastes. When septic tanks and soak-a ways ate included; only 15-20% of the population has an efficient means of human waste disposal. The remaining 20% lacked elementary sanitary facilities and the majority of these had no water supply.

Challenges to the Wetlands at Mainpuri

Apart from being highly productive as the habitat of birds, fishes and a variety of other aquatic life forms, including microorganisms, wetlands provide other ecosystem services, from maintaining the natural balance to sustaining human livelihoods. Unfortunately, there has been much neglect of wetlands in recent times through lack of appreciation of their role and the pressures of growing human need and sheer mismanagement of land resources. Many precious wetlands have been sacrificed and converted to other uses throughout India and elsewhere in the world. This trend has to be checked and reversed for the greater good. Various reasons which results in loss of wetlands at Mainpuri are enumerated here:

I. Loss and deterioration of their habitat by deforestation and cutting of trees.
II. The most significant, the loss of their wetland habitat through agricultural activities within these wetlands and the unsustainable use of these vital ecosystems. These activities include draining of wetlands for agriculture has often resulted in wetlands being drained and converted into crop production or planted pasture lands to some extent in Kirithua region. Other aspect of agricultural practices is use of pesticides and herbicides

on lawns and fields which threatens the existence of wetlands.

III. Poorly managed grazing, mowing and harvesting within wetlands. Wetlands have historically evolved with the presence of large indigenous herbivores, providing highly productive grazing-lands and thereby influencing the ecosystem structure and function. Many wetlands now lack these wild herbivores allowing domestic livestock to offer a practical alternative for enhancing these wetland systems. However, wetland marshes tend to have a lower grazing value because of the relatively unpalatable nature of the most mature marsh plants and the excessive wetness and softness of the soils, preventing their access.

IV. Poorly managed burning of wetlands. Again Cranes, as with many other bird and mammal species in wetlands, are the most affected by the winter burning of wetlands, as unfledged chicks are unable to escape these fires.

V. Other activities which may also affect wetland functioning Crop production (both agricultural and forestry crops) extending into wetlands, poorly managed forestry plantations leading to reduced runoff and extensive alien plant invasion, intensive animal production resulting in effluent disposal into wetlands .

Unless water conservation begins with the protection and correct management of wetlands, together with the entire catchment system we will find ourselves dealing with a survival crisis of immense proportion**.**

Policy planning and legislation

It is important that the government gives priority to policies which involve environmental protection. Environmental considerations must be incorporated into the planning of all major projects as a fundamental requirement. All major development projects should be preceded by environmental impact assessments as preventive action is the cheapest and most effective pollution control. Pollution-related, sectoral legislation needs to be revised with a view to harmonising and updating it to take into account the current situation. Comprehensive and more powerful environmental laws should be formulated and enacted. Enabling the relevant bodies to enforce such legislation, by supplying them with the appropiate resources, as legislation which is not enforced is worse than no legislation at all.

Administrative and institutional support

The government should facilitate the work of such sectors through budgetary allocations, manpower and facilities. In some cases, such as solid waste management, the division of responsibilities is not clearly defined, therefore, a department should be formed to specifically deal with these areas. There is also a need to strengthen cooperation among directly concerned institutions, in order to promote effective coordination of industrial pollution control issues.

Environmental research and technology

The government should encourage environmental research and technological innovation as a priority in its attempt to alleviate environmental pollution. Research on clean and waste reducing technologies should be given due consideration. Institutions engaged in environmental management and technological innovations, as well as industries and other entities showing sympathy to environmental issues, should be supported in order to encourage approaches aimed at preventing pollution.

Improving information, environmental education and public awareness

It is imperative to understand the causes and effects of pollution problems and to devise ways and means for their solution and prevention, based on viewing humanity as an integral part of the environment. Environmental education, both formal and informal, will inculcate the habits of preservation and conservation of nature in the general public. There is also an urgent need for research and technology advancement institutions, and environmental management bodies, to establish pollution monitoring programmes.

Public participation

Incentives to farmers and local people for protection of wetlands and birds, especially cranes should be promoted. Eco friendly tourism should be taken up, which should be managed by local people to increase their involvement for the conservation of wetlands.Public recognition of the value of wetlands has risen rapidly over the past 25 years. Today, scientists and environmental interest groups recognize how many different species and functions depend on wetlands and strive to increase public awareness of their importance in the natural order and to society. Yet much is to be done, sustainable environmental protection requires the involvement of local people.

The wetlands at Mainpuri require attention and concern for their conservation. Otherwise, in future they might diminish and disappear, which would result in loss of the rich fauna found here. Although Saman and Sauj (Site-III and IV) are IBAs (Important bird areas) under Important Bird Areas Programmes of BNHS and Bird Life International. Not only, that the area of Mainpuri be declared as 'Ecologically sensitive area' as per section 3 of the Environmental protection act, 1968. It should be declared as 'site for International importance, under Ramsar Convention of 1971'.

Protection laws and government initiatives

Wetlands conservation in India is indirectly influenced by an array of policy and legislative measures (Parikh and Parikh, 1999). Some of the key legislations are given below:

*The Indian Fisheries Act - 1857
•The Indian Forest Act – 1927
*Wildlife (Protection) Act - 1972
•Water (Prevention and Control of Pollution) Act - 1974
•Territorial Water, Continental Shelf, Exclusive Economic Zone and other Marine Zones Act - 1976
•Water (Prevention and Control of Pollution) Act - 1977
•Maritime Zone of India (Regulation and fishing by foreign vessels) Act - 1980
•Forest (Conservation act) – 1980
•Environmental (Protection) Act - 1986
•Coastal Zone Regulation Notification - 1991
•Wildlife (Protection) Amendment Act - 1991
•National Conservation Strategy and Policy Statement on Environment and Development– 1992

•National Policy and Macro level Action Strategy on Biodiversity-1999

Hardness

Hardness was noticed in water samples from different sites of Mainpuri, the low value of hardness in monsoon and post monsoon period is mainly due to the addition of rain water (Rai, 1974). Results indicate that it is hard water. It was measured maximum 290 ± 1.15 mg/l at site V during June11 and minimum 140 ± 2.30 mg/ltr. at site II during Dec.11. (fig-1).The higher values were obtained in summers, due to increase in temperature and increase in solubility of calcium and magnesium salts (Garg, 2003).The adverse effects of hardness are formation of kidney stones and heart diseases (Sasthree and Rathee, 1998; Freeda Gnana and Rani, 2003). Levels of hardness at different study sites differed significantly ($p \leq 0.001$).

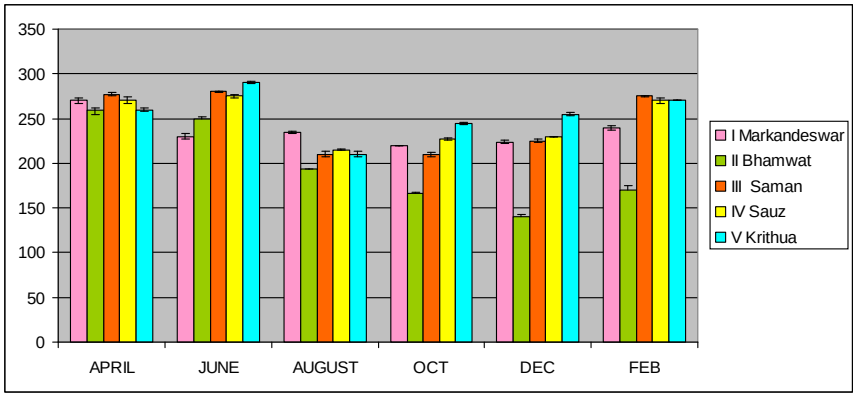


FIGURE 1: Showing variations in Hardness levels at different sites of Mainpuri region between April 2011 and feb 2012 Data are presented as Mean ± Sem, Error bars indicate standard error

Coliform count

This is indication of faecal pollution and is most critical parameter for water being safe for drinking and culinary use. This is due to scarcity of food and oxygen. In presence of albuminous sewage bacterial population first multiplies by reproduction, then its mortality is seen and their number decreases. (Edwin Oaks Jordon). Coliform bacteria are found in human and animal waste (fecain origin). Coliforms are "indicator" organisms associated with bacteriologically polluted water. (Makaya,2010).This significantly reduces the amount of oxygen available to other aquatic life. (Makaya, 2010). Coliform count was 8972 ± 1.73 to 32569 ± 1.732. (Fig-2). During present study, level of Coliform count at different sites differed significantly ($p \leq 0.001$).

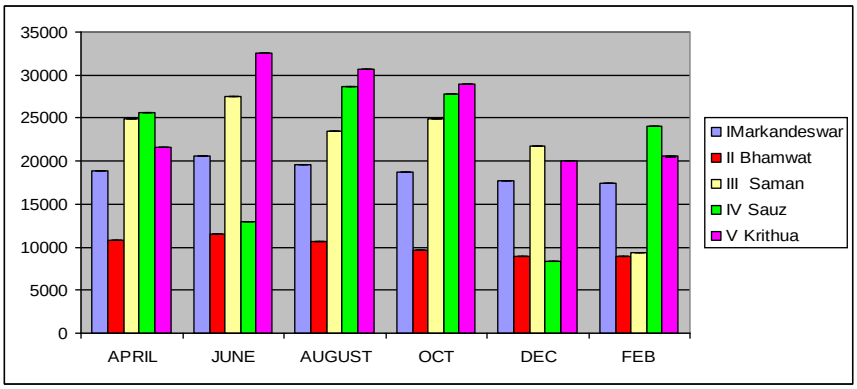


FIGURE 2- Showing variations in Coliform count levels at different sites of Mainpuri region between April 2011 and feb 2012.Data are presented as Mean±Sem,Error bars indicate standard error.

CONCLUSION

Water samples from Mainpuri appears to be basically alkaline in nature, although increased levels of carbonates and bicarbonates requires concern. The present study indicates that the studied sites have fluctuation in different nutrients during different parts of the year. The water is open surface water. Results indicate that it is hard water**.** Hardness of water fluctuates in different seasons. Although, Site-II samples showed lesser hardness; little cormorants predominated at this site, not many of birds could be observed here. At Site-IV, the water of the lake is almost completely covered by lotus *Nelumbo* and bordered with *Saccharum* on one side, and with a few scattered clumps of *Ipomoea carnea*, especially after monsoon (Rahmani, 1989). It is fresh water swamp and gets agricultural runoffs, a canal to the south takes away excess water to the Saman (Site-III).(Rahmani,1989). Higher values for hardness have been observed at Saman (Site-III) Sauj (Site-IV) and Krithua (Site-V). It indicates that

agricultural water is somehow reaching here in more quantity than the other sites (Site-I, Site-II). Although agricultural practices imparts nutrients to the water bodies. Coliform count indicates faecal pollution is abundant. Higher coliform count was also observed at Site-V. Wetlands of Mainpuri are rich in biodiversity with aquatic flora and fauna act as water purifiers and water filters .Therefore their maintenance is essential to keep up the ecological balance.Amongst the five study sites, Site-V appears to be most damaged , much eutrification and dryness has been observed here, due to anthropological activities. Therefore, these wetlands require more attention and more care is required for the two IBAs (Site-III and Site-IV).

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