Review article on the assessment of wetland

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ABSTRACT *This paper basically the review article of wetland as defined by the National Water Act, Act. 36 of 1998 as a transitional zone between the terrestrial and aquatic ecosystems where the water table is generally at or near the surface, or the land is periodically covered with shallow water, and which land in normal circumstances supports or would support vegetation typically adapted to life in saturated soil. Wetlands play a pivotal role in supporting extensive food webs and biodiversity. The review article has been done by nationally and internationally. In India the water quality analysis, socio economic values of the wetland has been incorporated for the assessment of wetland. Internationally the assessment of wetland has been done on landscape rather than the individual. Wetlands have been taken as a geomorphic unit. From the explicit literature review some research gaps have been identified which carries the future direction the research. The work on Wetland Index has not been incorporated yet for the assessment of wetland. The nature of wetland is different from the piedmont to plain. The identification and the delineation of wetlands is the first and foremost criteria for the assessment study. Therefore; the study will be auxiliary to plan for restoration and sustainable management of wetlands.*

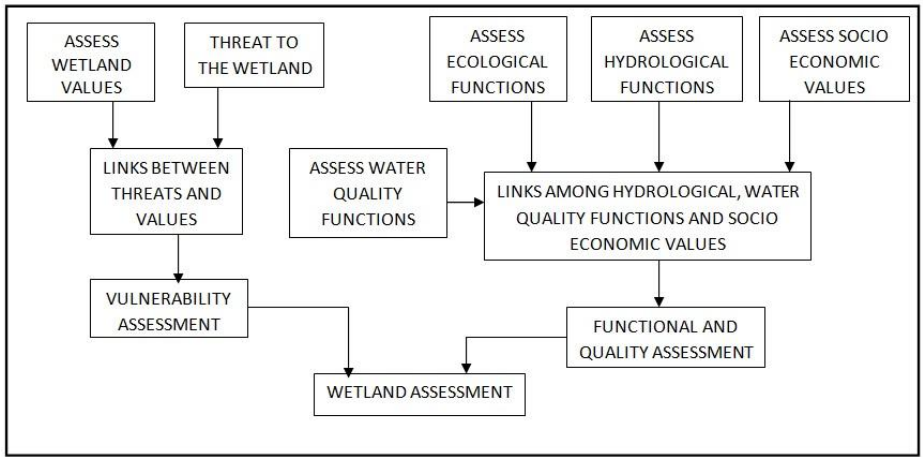
Keywords: *Wetland Assessment, Wetland Index, sustainable management*

Introduction:

'Wetland (Mitsch and Gosselink, 1986; Dennison and Berrey, 1993), a relatively new term occupies a significant position as natural resources. Wetlands, as the term implies, are "wet" lands that exist because the inflow of water exceeds the outflow for brief to extended periods of time during the growing season. Inland wetlands receive water from precipitation, river outflow, and surface overland flow, seepage from streams, lakes, ponds and irrigation systems. Most natural wetland functions are a result of or closely related to wetland hydrology (Ramachandra, 2001).

Wetlands can be defined as "areas of marsh, fen, peatland or water whether natural or artificial, permanent or temporary, with water that is static or flowing, fresh, backish or salt including areas of marine water the depth of which at low tides does not exceed six meters".(Ramsar convention, article 1.1)

Wetland assessment is the gathering and analysis of information needed for wetland decision making. Wetland assessment not only deals with the "function" and "value" but most of the work on assessment focused on functions and values. Assessment of wetland can be assessed in many ways like the functional assessment, risk assessment, quality assessment and hydrological impact assessment. Geomorphology is the first driving factor for the distribution of wetland because it determines topography and the nature of deposits, thus water pathways and residence times. Topography is the driving force for the water movement. (Curie et.al, 2007) Wetland can be taken as geomorphic unit. (Li Z J, 1982, 1987)



Assessment of wetland:

National Aspect:

Ramachandra T.V and Ahalya N. (2001) emphasized on the restoration and conservation of wetland resources in Bengalore in "*Wetland restoration and conservation*". The water quality monitoring of different lakes revealed the highly eutrophic nature of the lakes. Most of the developmental activities concentrated in and around the city and this population pressure leads to the disappearance of lakes. The number of lakes decreased from 379 in 1973 to 246 in 1996 which affect the groundwater level. The groundwater table had been lowering from 80 feet to 300 feet in certain localities. So, the authors suggested some suitable strategies for the restoration. Sahu Paulami,Sikder K. Pradip(2011) considered East Calcutta Wetland as a fresh water peri-urban inland wetland ecosystem in "*Ground water potential zoning of a peri- urban wetland of South Bengal Basin, India*". Overlay analysis in GIS using multiple criteria such as water quality index, hydraulic conductivity, groundwater velocity and depth to piezometric surface reveals that in and around ECW there are 5 groundwater potential zones. About 74% aquifer shows poor to medium groundwater potential. It illustrated the importance of determining the groundwater potential of inland freshwater wetlands. Ramachandra T.V,Kumar Uttam and Aithal H. Bharath (2012) in the "*Ecological approach for mitigation of urban flood risks" adopted* Supervised classification of image using Baysian Classifier of 1973, 1992, 1999, 2000, 2002, 2006, 2009. Toposheets of 1:50,000 and 1:250000 scales are used for base layers. To determine the growth pattern the study area is divided into concentric circles of 1km. radius. LST and NDVI have been calculated of Greater Bengalore in 1999, 2000 and 2007. The correlation between LST and NDVI investigated through Pearson's correlation coefficient at a pixel level and the significance tested through the one tailed student t-test confirmed the relationship. Higher the population density indicates higher LST due to the higher anthropogenic activities. The growth pole is towards N, NE, S and SE of the city. With the increase of urbanization the number of lakes has led to decrease. Roy B. Malabika,Roy K. Pankaj,Samal R. Nihar and Mazumder Asish (2012) evaluate the economic valuation of an important floodplain wetland in the lower Gangetic basin through "*Socio –economic valuations of wetland based occupations of lower Gangetic Basin through participatory Approach*" . The focus is extended to notice the status of different mouzas with respect to their economic structure through cluster analysis and to optimize the number of working population involved in different occupations in such a way that the per capita economic valuation of each mouza is maximized. In this study, the wetland related occupations are selected and with help of income estimation method, the economic valuation of every mouza is calculated. Minitab-15 is applied to get a complete scenario of status of the mouzas in terms of their economic structure through the cluster analysis. However, the optimization problem boils down with the help of Matlab environment. The management options are also highlighted to conserve the wetland as well as to uplift the stakeholders' livelihood. With the help of different analysis, the paper concludes that the majority of the population should go for farming followed by fishing and then other occupations. Alakananda B, Mahesh M.K & Ramachandra T. V (2013) studied the effectiveness of restoration using diatom as bio-indicators in Bengalore in "*Bio-monitoring to assess the efficacy of Restoration and management of urban water bodies*". Five wetlands i.e prior-restoration, post-restoration, polluted reference &previously restored wetlands have been chosen. The water quality reveals there is no as such change in conductivity among prior-restoration and post-restoration period. Influence of chemical factors was evident from the varying diatom assemblages in water bodies. One way ANOVA revealed a significant change($p<0.05$) in the percentage of eutrophic taxa from a reference to polluted wetlands but no %ET change was noticed among prior, post and previously restored wetland types. So it reveals the ecological integrity, cost effective supplement to chemical analysis and easily implementable for monitoring urban wetlands. Das T.K,Moitra B.,Roychaudhury A. Jash T,Ghosh S.& Mukherjee A. have selected 10 inland wetlands in Bardhaman district for the study of impact of economic activities on degradation of wetlands in the paper entitled "*Degradation of water bodies and Wetlands in West Bengal: Interaction with Economic Development*". A detailed questionnaire survey was prepared for different focus groups of stakeholders. The benefits of wetland calculated using market price and surrogate price method. The D.O level is also calculated to determine the water quality. It shows that the anthropogenic activities in wetlands are fatal for the degradation of wetland ecosystem and D.O level also distorted where the irrigation facility intensified. The cost benefit analysis has shown that the benefit foregone collectively by losers.

Ramachandra T. V & Bharath H. Aithal (2016) shows the temporal changes of land cover from 1973 to 2013 in the paper namely "Decaying lakes of Bengaluru and today's irrational decision makers". With the increase of urbanization (paved surface) the vegetation covers and wetlands are decreasing 88% and 79% respectively. Remote sensing data with field census incorporated that 1.5 million trees are in Bengaluru for 9.5 million human populations. Field survey of 105 wetlands reveals that 98% lakes have been encroached

for illegal buildings. Geo-visualization of land use using 2020 through a multi criteria decision making techniques (Fuzzy AHP. Analytical Hierarchical Process) reveals that 93% landscape of Bengaluru filled with paved surfaces and drastic reduction in green cover and open spaces.

International aspect:

Whigham F. Dennis (1999) emphasized on preservation of the dry wetlands than the other created or individual wetlands in the paper "*Ecological issues related to wetland preservation, restoration, creation and assessment*". From an ecological perspective, dry-end wetlands such as isolated seasonal wetlands and riparian wetlands associated with first order streams may be the most important landscape elements. They often support a high biodiversity and they are impacted by human activities more than other types of wetlands. So, Whigham suggested hydro geomorphic approach for the assessment of wetland which was very effective tool for the biodiversity and function of wetlands. He mainly stressed on the landscape than any other wetlands. The reference wetland system is very much effective for the protection of wetland management. Rountree et. al (2007) developed a wetland habitat integrity index for floodplain and channeled valley bottom wetlands in south Africa. They prepared indices for wetland assessment in conjunction with the functional and biological assessment indices. The Alaska department of Transportation and Public facilities (2010) introduced state highway project in Kenai river area. At first scientists had been delineated the boundary of wetlands in the project area, then the functional assessment had done. The scientists adopted some primary and secondary indicators of a particular function such as water quality functions, hydrological functions, ecological functions, socio-economic uses and values. After the assessment it was cleared that the constructional activity will be resulted in temporary impacts of wetlands in the project area. Stratford j. Charlie, Acreman C. Mike and Rees Gwyn H. (2011) applied four methods for the vulnerability assessment of Rupa Lake, Phewa Lake and Gokyo Lake in Nepal in "*A simple method for assessing the vulnerability of wetland ecosystem services"*. It consist of assessment of wetland values, assessment of threats to wetland, links between wetland values and threats to wetland and the vulnerability assessment. The data have been collected through the discussion with local stakeholders and secondary data source. After the collection of data the scores H, M, L and N or Unknown (U) score is given to each value and threat. After this the table prepared which shows the link between values and threat. At the final table all the values are integrated in a matrix. The final assessment table shows the clear lists of values under threat and very effective for the site action plan.

Parameters and methodology

The literature review has been done by both nationally and internationally in an explicit way. Nationally the parameters DO, BOD, temperature, total dissolved solids, electrical conductivity, pH, chloride, alkalinity, and total hardness, Na, K, Phosphate, and Nitrate have been adopted for the water quality assessment. The GIS and remote sensing software mainly used in this country for the identification and change detection of the wetlands. The correlation between NDVI and LST is mainly done to know the status of water bodies. With the increase of urbanization the impact on the wetlands are commonly used as a parameter for the assessment of wetland nationally.

On the other hand internationally landscape analysis takes as a priority than the individual wetland. The climate data and evapo-transpiration ,water table, average moisture, carbon, nitrogen, wet moisture, dry moisture, organic carbon, waterfowl or other bird population, zonation of vegetation, population density, habitat parameters, wetland area, number of breeding pairs have been used for the assessment of wetland. Internationally the total assessment is done with the correlation between the wetland values and threats.

Research voids:

Research gaps have been identified after an explicit research review. These research gaps give the future research direction. The gaps are given as follows:

- There is no such work on the evolution of wetlands in a piedmont zone. The nature of wetland in piedmont zone is different from plain.
- In India, Wetland Index has not been incorporated yet in the assessment study of wetland. The Wetland Index has been used in the United States for the quantitative assessment of the wetlands. The quantitative assessment is more important than the qualitative assessment to evaluate the status of wetlands and the sustainable management.
- Bottom sediments actually the unused materials deposited at the bottom after death. The importance cannot be ignored as a part of the aquatic food web (Odum and Smalley, 1959). So, the

bottom sediments can be incorporated as an important hydrological parameter in the Wetland Index. Bottom sediment reflects the nutrient status of wetland which is very effective for the immense production potential (Pathak, 1989).

Conclusion:

From the above literature review, it has been concluded that the wetland has a great importance not only ecologically but also it has climatic and geomorphic importance. The hydro-geological study of the wetland reveals the wetland as a geomorphic unit. There are many definitions about wetlands. The definition can be varied with the changes of geomorphic set up of the area. So the identification of wetland is first and foremost problem in the assessment study. Wetlands have value because their functions have proved to be useful to humans. The unit value for some wetlands also increases with human development (agriculture and urban) because of increased use and/or increased scarcity. The non-use value cannot be ignored. Both the use and non use value give the total wetland value. Nowadays the increase of use value effect on the non use value. To conclude, there is necessity to construct plans for the preservation of such natural wetlands whose environmental importance cannot be ignored.

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