Environment and Ecology 37 (3A) : 921—925, July—September 2019
Website: environmentandecology.com ISSN 0970-0420

# Sediment Characteristics of Gudavi and Associated Wetlands in Soraba Taluk, Shimoga (Dist), Karnataka, India

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Received 11 March 2019; Accepted 15 April 2019; Published on 6 May 2019

**Abstract** This study was undertaken to investigate nutrient level in the sediment samples collected from different stations of Gudavi Wetlands which is located in Central Western Ghats of Shimoga District, Karnataka lies between Latitude $14^0$25´59´´-$14^0$26´41´´N and Longitude $75^0$6´43´´-$75^0$25´28´´E. Sediment characteristics like pH, electric conductivity, organic carbon, available nitrogen, phosphorus, potassium, and micro nutrients Fe, Mn, Cu and Zn was monitored over a period of one year (February 2016 to January 2017). Five stations were selected for sediment sampling by using core sampler. The highest concentration of Fe was recorded from all the stations (291.6 ±8.61>284.75 ± 11.53>284.09±8.69>260.01 ± 13.36>258.16 ± 36.24 ppm), similarly available phosphorus showed high *in site* 2 (37.8 ± 18.12 ppm) and organic carbon recorded *in site* 1 (1.62± 0.16%). The highest concentrations of the nutrients observed in summer (February, March, April and May). This might be indicated that dissolution of Fe from the mineral rocks run-off from the catchment area and phosphorus also entered through run-off and accumulated in the bottom sediment. Therefore, a continuous monitoring of nutrient level in the sediment of the wetlands help to understand the trophic status of wetlands. In addition to this any significant changes which may take place in the area also noticed. This results of this study would serve as important baseline information for future reference.

**Keywords** Sediment quality, Magnesium, Gudavi, Wetlands in Soraba Taluk.

## Introduction

Wetlands make up a major part of the flooded area of the Indian Great Lakes, and take part in important functions which results in direct consequences on the lakes ecosystems. These wetlands regulates in restoration of nutrient load like nitrates and phosphorus (Michener et al. 1997, Morris et al. 2002). Sediment characters in the wetlands plays major role in nutrient cycle of aquatic ecosystem and responsible for movement of important nutrients and pollutants. Hence, the assessment of sediment is more conservative for measure the nutrient load of contamination and toxicity (Shiji et al. 2015). Sediment pollutants received through natural and human activities. Wetlands may

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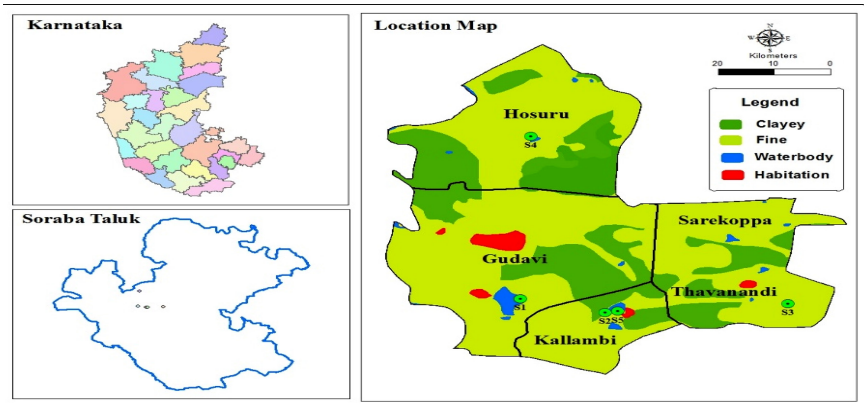


**Fig. 1.** Map representing sampling stations and type of soil.

be polluted by the waste water run-off, airborne contaminants through rainfall, dust precipitation, sludge and domestic activities. Further, sediment reveals a past data of pollutants recorded since it has the capacity to load several elements (Mekonnen et al. 2013). Human pressure are a main source of metal concentrations (John and Smart 1986).

In Gudavi Wetland decomposition of aquatic plants and eroded organic rich sediment is an important component of regulating nutrients. The process of decomposition includes the degradation of plant remain and transport of organic matter. The movement of nutrients to the soil and peat formation is organized by the amount of decomposing litter and aquatic plant remains. The rate of decomposition is influenced by a range of factors such as nature and abundance of microorganisms, physico-chemical properties of sediment, peat quality, climate factors (Sarkar et al. 2016). In Gudavi and its associated wetlands is located in Western Ghats, Karnataka and well-known bird sanctuaries of Karnataka. Gudavi bird sanctuary lies between North Latitude 14$^0$25′59′′ to 14$^0$ 26′ 41′′ and East Longitude 75$^0$ 6′ 43′′ to 75$^0$ 1′ 28′′. The catchment area for this sanctuary is mainly agriculture land and other forest areas.

## Materials and Methods

### Study area

The study was carried for a period of one year (February 2016 to January 2017) at Gudavi Wetland, which is coordinated between Latitude 14$^0$25′59′-14$^0$26′41′′ N and Longitude 75$^0$6′43′′–75$^0$25′28′′E (Fig. 1). Five sampling stations were monitored in the Gudavi and its associated wetlands, namely Station 1 Gudavi (14$^0$26′20.8′′ N 075$^0$00′55.8′′E), Station 2, Kallambi (14$^0$26′09.9′′ N 075$^0$01′42.9′′E) and Tyavagodu, Station 3 (14$^0$25′16.7′′ N 075$^0$03′24.1′′E). S4 Hosuru

**Table 1.** Average and standard deviation values of sediment at different sites during the study period (from February 2016 – January 2017).

| Sl. No. | Sediment parameters | S1 | S2 | S3 | S4 | S5 |
|---|---|---|---|---|---|---|
| 1 | pH | 5.81 ± 0.89 | 5.76 ± 1.17 | 5.02 ± 0.39 | 5.63 ± 0.51 | 5.64 ± 0.72 |
| 2 | EC | 0.91 ± 0.22 | 1.01 ± 0.75 | 0.24 ± 0.06 | 0.33 ± 0.07 | 0.65 ± 0.21 |
| 3 | OC (%) | 1.62 ± 0.16 | 1.45 ± 0.64 | 1.4 ± 0.24 | 1.37 ± 0.48 | 1.34 ± 0.41 |
| 4 | $P_2O_5$ ppm | 32.14 ± 25.69 | 37.8 ± 18.12 | 18.37 ± 0.43 | 18.4 ± 0.2 | 15.81 ±1.55 |
| 5 | $K_2O$ ppm | 0.19 ± 0.17 | 0.37 ± 0.3 | 0.11 ± 0.04 | 0.15 ± 0.07 | 0.15 ± 0.06 |
| 6 | Fe ppm | 258.16 ± 36.24 | 284.09 ± 8.69 | 291.6 ± 8.61 | 284.75 ± 11.53 | 260.01 ± 13.36 |
| 7 | Mn ppm | 11.76 ± 3.6 | 17.49 ± 0.99 | 16.27 ± 0.3 | 15.93 ± 0.27 | 10.02 ± 1.22 |
| 8 | Cu ppm | 2.51 ± 0.93 | 2.55 ± 0.43 | 2.95 ± 0.27 | 2.55 ± 0.91 | 1.55 ± 0.02 |
| 9 | Zn ppm | 0.45 ± 0.015 | 0.33 ± 0.24 | 0.47 ± 0.005 | 0.38 ± 0.14 | 0.56 ± 0.12 |

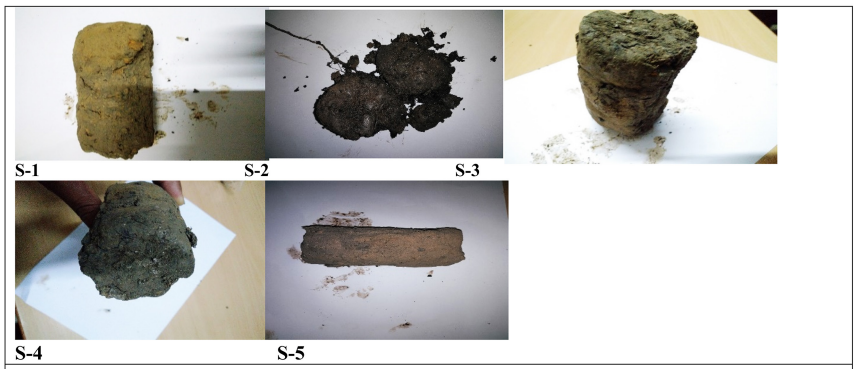


**Fig. 2.** S1-S5. Sediment core samples from five different sites.

($14^0$28´33.2´´N $075^0$01.01´5´´ E) and S5 Sampagodu ($14^0$ 26´10.6´´ N $075^0$01´50.4´´E) (Table 1).

Sediment collection and analysis

Soil samples were collected randomly at all five different sites (February 2016-January 2017) from 0-30 cm depth using sediment Wildco hand core sampler (Fig. 2), which were then transferred into an acid washed polyethylene box wrapped with aluminium foil, kept in refrigerated box. Soil organic carbon was estimated (John et al. 2012) pH (pH pen model), phosphorus by colorimetric method and potassium by flame photometry and micronutrients Fe, Mn, Cu and Zn by atomic absorption spectrophotometer (AAS).

**Results and Discussion**

Sediment characteristics is one of the major factors to know the status of wetlands, supports aquatic life but also enriches the water body with various nutrients required for biological production. However, the exchange rate of nutrients from bottom soil depends upon temperature, pH and nutrients. Chemical parameters of bottom sediment including pH, EC, organic carbon (OC%), available phosphorus (available-P), potassium (exchangeable-K) and micronutrients Fe, Cu, Mn and Zn were recorded at the five sites in the Gudavi Wetland during the study period. The pH values of sediment recorded at the different sites found the rangevalue form 5.02 ± 0.39 to 5.81 ± 0.89 (Fig. 3). The mean values of pH among the sites and showed more or lessimilar trends throughout the study period. The highest pH value observed at the Gudavi site and the lowest at the Tyavagodui i.e. Station 3.

Organic carbon is rich in the wetlands and recorded from 1.34 ± 0.41% to 1.62 ± 0.16 % (Fig. 3B). The highest values was recorded in Station 1, which differs significantly at different sites, it is due to decomposition of aquatic vegetation mainly the dominated species salvinia plant which is completely covered. The observed concentration of phosphorus in the Gudavi Wetland sediment show from 15.81 ± 1.55 ppm to 37.8 ± 18.12 ppm. Concentration of potassium (Fig. 3A) in sediment at different sites recorded (from 0.11 ± 0.04 ppm to 0.37 ± 0.3 ppm), which differs significantly increasing in summer season. The obtained results indicate that continuous accumulation of nutrients in the bottom sediment system, which is associated with the sedimentation of suspended solids carried by agriculture run-off.

The Cu concentration ranged between 1.55 ± 0.02 ppm to 2.95 ± 0.27 ppm (Fig. 3E) shows higher in summer season due to sediment deposition. Further Fe is more due presence of iron oxides accumulation in and around the study location. The mean values of Fe concentration observed 258.16 ± 36.24 ppm to 291.6 ± 8.61 (Fig. 3C) from different stations, with lowest concentrations in the dry season and the mid-wet season. The mean concentration of Mn varied for all stations 17.49 ± 0.99>16.27 ± 0.3>15.93 ± 0.27> 11.76 ± 3.6>10.02 ± 1.22 ppm (Fig. 3D). The Zn

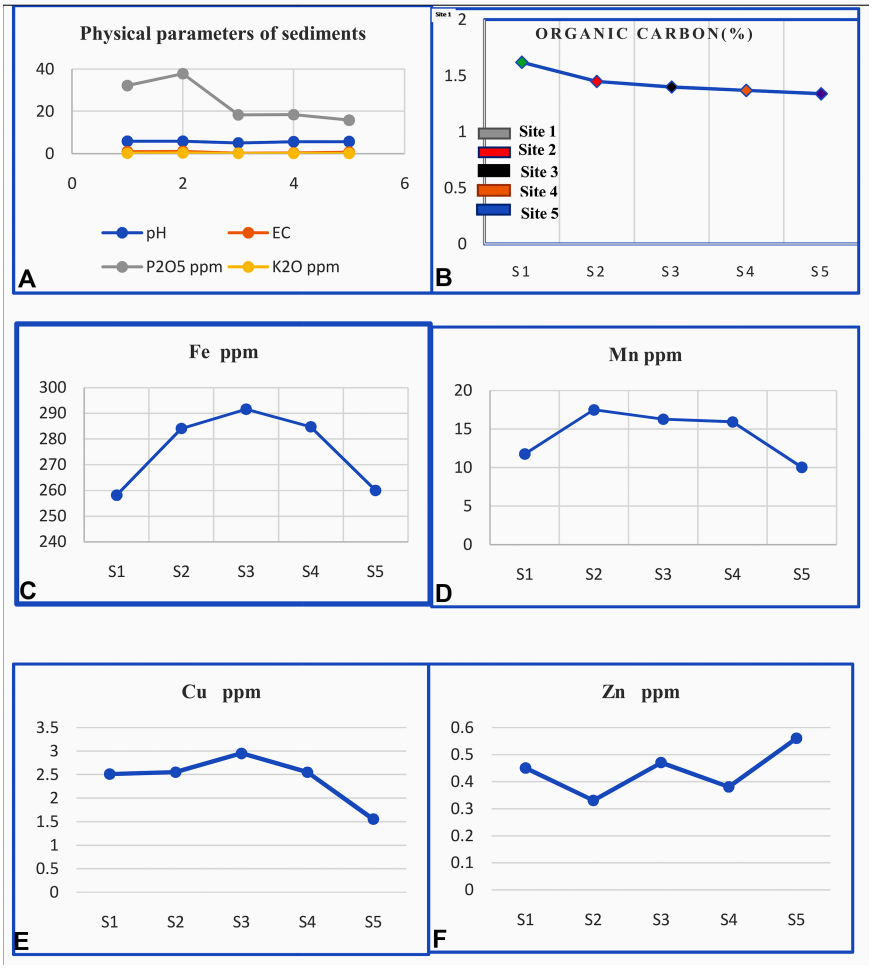


**Fig. 3.** Nutrient level recorded in the different sediment samples.

concentration ranged from 0.33 ± 0.24 ppm to 0.56 ± 0.12 ppm (Fig. 3F) for all stations in the study period. The increasing soil acidity reflects the accumulation of Zn in sediment.

## Conclusion

The present study evaluated the nutrients level in Gudavi and its associated wetlands. pH shows highly acidic in Gudavi Wetland. Whereas the other wetlands pH shows slightly acidic in nature. Further, organic carbon, potassium, phosphorus values shows increasing trend during summer. The assessment study concluded that organic carbon (OC) varied seasonally in Gudavi Wetland. Sediment analysis reveals that inter dependence of different of pH, phosphorus, potassium, Fe and OC. Heavy metals traces distributed in the following order Fe>$P_2O_5$>Mn>Cu>$K_2O$>Zn.

In the Gudavi Wetland sediment consists of macronutrients, Fe and Cu load due to presence of minerals in the soil. Subsequently phosphorus manifest dominantly due to anthropogenic contributions and also both Mn and Zn concentration in the sediments. Since, the enrichment of heavy metals in the sediment effect the quality of water, serious attention should be given to the sources that may cause the heavy metal pollution in the Gudavi Wetland sediments. Gudavi Wetland is known for good habitat for birds due to rich growth of aquatic fauna

and flora. Thus control measures need to be taken to protect the natural ecosystem and without disturbing the ecological balance.

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