

Impacts of Land Use/Cover Change on Water Quality in Lake Bosomtwi Basin of Ghana

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ABSTRACT

Land use/cover alteration within lake basins is occurring at accelerated rate most importantly in developing countries like Ghana. Anthropogenic activities (livelihood change, population growth, agricultural intensification and practices) and natural factors like seasonal variations are in most situations the major cause. To examine the effects of land use/cover on the physico-chemical and biological properties of Lake Bosomtwi, satellite images of the Lake's watershed covering the study periods (1990, 2000 and 2010) were obtained and processed to determine the land use /cover changes that have taken place over the study period. Samples of water and soil were collected from December 2013 to May 2014 from seven different sites within the lake Bosomtwi watershed for investigation. All physical water quality parameters were measured in-situ.

The observed temperature of the Lake water was relatively high varying from a minimum of 27.6 °C to 33.6 °C, with a mean value of 30.4±1.5 and an average pH value (9.0±0.6) depicting a highly alkaline Lake water. The result showed salinity range of 0.40 ppt to 0.56 ppt which was slightly above the WHO standard of 0.5 ppt for drinking water. Conductivity values were also generally high with a mean value of 1352.7±27.6 µS/cm. The mean values recorded for the other physico-chemical parameters were; Turbidity 6.1±4.6 (NTU) , Apparent Color 67.8±22.4 pt.co, TDS 645.6±48.1 mg/L, TSS 6.8±5.3 mg/L, DO 7.5±0.9 mg/L, BOD 3.7±1.0 mg/L, COD 98.9±10.8 mg/L, Nitrate 1.3±0.3 mg/L, Nitrite 0.01±0.02 mg/L, Phosphate 0.40±0.19 mg/L and Ammonium 0.018±0.017 mg/L. All the studied biological indicators were significantly high compared to the WHO standard for good water quality making the Lake water unfit for most domestic purposes without partial treatment. The result from the soil analysis showed that, soil EC varied from 176 to 454 µs/crn, pH 6.7 to 8.6, total coliform and *E.coli* ranged from non-detectable levels to 350000 mg/L and 120000 mg/L, respectively. Also, average soil nutrients levels were; nitrogen 0.24 ±0.17 mg/L, phosphorus 5.38±4.45 mg/L and ammonium-nitrogen 0.39±0.52 mg/L.

Several strong correlations (using Pearson's Correlation) was found among the studied parameters; temperature was significantly related positively with Conductivity and Salinity while total suspended solids correlated with eight parameters including temperature, apparent color, nitrate and others. Strong correlations were also established between some of the studied water parameters and that of the soil from the various land use/cover which includes EC, pH, TC and *E. coli*.

The study revealed that, there has been a continuous transformation of the vegetation cover within the Lake Bosomtwi watershed in the twenty year period. As close forest vegetation and the Lake water reduced in coverage, agricultural/cultivated areas, bare surface built up areas inter alia increased in coverage over the years. It was evident that the reduction in fish catch from the lake has negatively impacted on the lives of the people including unemployment, increased poverty among others. The study recommends that, land use activities within the lake Bosomtwi watershed should be regulated and also the buffer zone created around the lake should be well demarcated and maintained. Providing alternate source of employment/livelihood can help reduce the pressure exerted on the land around the Lake and to allow the vegetation around the lake to replenish itself.

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