



## Review Article

# Impact of Agriculture, Urban and Forest Land Use on Physico-Chemical Properties of Water – A Review

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## ABSTRACT

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The land use within the watershed has great impact on the surface water quality. The water quality may degrade due to change in the land cover patterns within the watershed as human activity increase. Land use impacts water quality through non point sources, which are major contributor of pollution to surface and ground water that are difficult to regulate. Water pollution is any human-caused contamination of water that reduces its usefulness to humans and other organisms in nature. Land use is likely to effect the hydrological cycle in terms of both water quantity and quality. It affects the rates of runoff, infiltration, water quality and vegetation of the watersheds. Surface waters like streams and lakes are not the only water sources that suffer from pollution but even groundwater aquifers, which are critical sources of both drinking and irrigation water, are also affected. The physico- chemical characteristics of an aquatic body provide information on water quality and pollution status.

## Introduction

Clean fresh water is essential for terrestrial and aquatic life, and “water quality” is a term used to describe the physical, chemical, and biological characteristics of water (Carr and Neary, 2008). The effect of poor water quality on human health was noted for the first time in 1854 by John Snow, when he traced the outbreak of cholera epidemic in London to the Thames river water which was grossly polluted with sewage. Since then, the science of water quality progressed (Olajire and Imeokparia, 2000).

It has been widely accepted that there is a close relationship between the land use type and water quality (Huang *et al.*, 2013). Stream water is affected by several processes in the watershed including anthropogenic activities that result in changes in quality of water and its functioning. According to Agarwal *et al.* (2000) land use change is an important and complex environmental issue that needs "many eyeballs" working together. They stated that water quality parameters including temperature, dissolved oxygen,

pH, total suspended solids, nutrients, and heavy metals are crucial to the survived habitat and critical to the quality of water resources. Land conversion for agricultural and urban development impacts stream and river ecosystem dynamics by changing hydrological regimes and increasing sediment and pollution loads (Zhang *et al.*, 2010).

### **Effect of Agriculture, Urban and Forest Land use on water quality**

Studies demonstrate that surface water quality has deteriorated noticeably in many countries in the past decades due to poor land use practices indicating by the strong relationships between declining water quality and increasing agricultural development at catchment scale (Buck *et al.*, 2004). Agriculture often has great effects on water quality.

Chemicals like herbicides, insecticides, and fertilizers, particularly when more is applied than is needed, can run off into waterways or seep into groundwater (Viman *et al.*, 2010). The intensive uses of agriculture inputs and continuous cropping often contribute to environmental deterioration, degrading soil and water resources (Warren *et al.*, 2008).

Water quality in agricultural systems is associated with the amount of soil lost as runoff into surface water and with the amount of plant nutrients (Nitrogen and Phosphorus) and pesticides that reach surface waters (Nafziger, 2009). Intensive agriculture and growing demands for energy during the last few decades has affected the physical, chemical parameters and biological attributes of the surface water (Jain *et al.*, 2007).

Discharge of sewage, domestic waste and

industrial effluents resulted in variety of changes in the hydrology and water quality (Mahadev and Gholami, 2010). Urban development mostly has a negative effect on water quality. Urban development reduces the uptake of water, which causes water in urban areas to collect chemicals and pollutants. This takes the chemical pollutants to larger bodies of water, such as streams or ponds, and damages the water quality. According to Osborne and Wiley (1988) urban land development greatly influences water quality.

A significant amount of P and N enters surface waters from urban nonpoint sources, such as construction sites, runoff of lawn fertilizers, pet wastes and inputs from sewage (Carpenter *et al.*, 1998). Urbanization and Deforestation are some of the land use practices that result in increased soil erosion and subsequent load of sediments and nutrients into aquatic systems (Seitzinger *et al.*, 2010).

Conversion of natural forest to other forms of land uses such as farmlands and pasturelands can provoke soil erosion and lead to a reduction in soil nutrients. Forests have a strong influence on catchment hydrology and water quality. Interception and evapotranspiration processes in forests reduce the amount of precipitation reaching the forest floor. The physical, biological and chemical characteristics of forest soils facilitate water filtration, contaminant removal and nutrient recycling.

As a result, forests generally yield higher water quality than other land uses such as agriculture and urban development (Foley *et al.*, 2005). Soil erosion, salinity and absence of vegetation cover are early warning signs of land degradation, which are likely to influence adjacent aquatic systems through sediment loading.

## **Review on results of physico- chemical properties of water in relation to agriculture, urban and forest land use**

The degree of pollution is generally assessed by studying physical and chemical characteristics of the water bodies (Duran and Suicmez, 2007). The evaluation of physical & chemical properties of water in different countries has become a critical issue in recent years due to the population increase and the growing demand for water (Paliwal *et al.*, 2007). Islam and Weil (2000) studied that the conversion of forest land to agriculture crop land resulted in degradation of adjacent aquatic system. Pesticides and fertilizers are often cited as examples of agricultural contaminants, but soil erosion continues to be a primary cause of water-quality problems. Certain chemicals, such as nitrogen, phosphorus, can distort and disrupt aquatic ecosystems by overfeeding. Kathikeyani *et al.* (2002) studied the water quality of the river Shanmuganadhi, Tamil Nadu and found the water unsuitable for drinking and irrigation purpose due to dispersal of sewage water from surrounding area.

Chattopadhyay *et al.* (2005) monitored water quality in Chalakudy river basin in Kerala in different land use types during four seasons and reported that urban land use had poor water quality throughout the year which was linked to fluctuations of drainage discharge and changes in land use patterns. In the industrialized world, eutrophication is a common problem in fresh water ecosystems. It is also an important issue of water environment that has been attracted by many countries in the worldwide Wang *et al.* (2008). Li and Zhang (2008) studied physico-chemical characteristics of upper Han River in China and reported that water was slightly alkaline with low ionic strength. The lowest solute

concentration was observed in catchment with high vegetation cover and higher chloride, nitrate and sulfate concentration occurred in the catchment with industrial establishment.

Gupta *et al.* (2009) accessed total dissolve solids, pH, alkalinity, total hardness, chloride, nitrate, calcium and magnesium in Kerwa and in Kaliasote water samples in Bhopal, Madhya Pradesh and reported pH (7.4–7.8), alkalinity (140 mg/l), total hardness (144 mg/l and 140 mg/l), chloride (22 mg/l and 54mg/l) nitrate (30 mg/l and 2 mg/l), Ca (36mg/l and 12 mg/l) and Mg (28mg/l and 16 mg/l), respectively. Manssour and Mufti (2010) studied the influence of human activities on water quality of Quttina Lake in Syria and reported increased organic pollution due to sewage discharge into water body from urban areas. Murphy *et al.* (2015) reported that phosphorus loss from soils to water can be a major pressure on fresh water quality. Lampthey *et al.* (2013) studied the Keta lagoon and its catchment in Ghana, West Africa & reported that intensive agriculture and use of agro chemicals have affected the water quality of Lagoon. Hassan *et al.* (2015) studied the impact of land use/ land cover on water chemistry of Wullar Lake in Kashmir and reported catchment area with greater percentage of agriculture fields drains maximum fertilizers in Lake Reservoir which resulted in the depletion of dissolve oxygen of water body.

Chauhan *et al.* (2014) reported heavy metal pollution in surface and ground water under urban, agriculture and forest land use. Main source of heavy metals are geology of the area and anthropogenic cause such as use of agrochemicals in farm lands and effluents runoff from urban waste. Gupta *et al.* (2014) studied impact of agriculture, urban and forest land use on surface water quality

and reported that urban land use had greater influence on surface water quality followed by agriculture and forest land use. They reported that all the physico-chemical parameters of water were within permissible limits except calcium.

Water is an essential commodity for survival and the improvement of quality of life. Human population growth and land use changes have deteriorated water quality. Different land uses impact the water quality and makes it unfit for use. Proper land use management is required in order to prevent the pollutants loads into water resources.

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