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Impact of land use on quality of surface water in a hilly watershed

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ABSTRACT : Surface water flows through various land uses on its course before it is used for domestic as well as for livestock consumption. Physio–chemical as well as biological properties of surface water are affected by weathering of parent rocks, constituents of rainwater and anthropogenic activities. In simple term, it can be said that natural and manmade activities operating in the catchment govern the quality of water to a great extent. The present study was conducted to study the effect of different land uses and human interventions on different parameters of water quality. Surface water samples from five most prevalent land uses in the region ***viz.,*** forest, low land paddy, agricultural fallow, agriculture on bench terrace and *Bun* system of agriculture were collected periodically during monsoon season of 2008 and analysed for physio–chemical and biological properties. Average value of pH of water from all the land uses was acidic in nature. However, pH value of water from forest land use falls within the permissible limit prescribed by World Health Organization (1984) for drinking water standards. Other parameters such as conductivity, total dissolved salts, total alkalinity and hardness were within the maximum limits under all the land uses. Sodium was found to be dominant with its highest concentration of 148.77 ppm than other cations; calcium, magnesium, and potassium. However, concentration of all the cations in water samples of all the land uses was within the permissible limits. Concentration of nitrate (except in the water samples from agriculture land use on bench terrace) and phosphate in all the land uses was higher than the permissible limit of 45 and 2-3 ppm, respectively prescribed by Environmental Protection Agency (EPA, 1976) from water environment protection point of view but their concentration was below the WHO standards (1984) for drinking water. Iron content in the surface water from all the land uses except forest land use exceeded the maximum permissible limit prescribed by WHO for potable use of water. Faecal Coliforms (FC) was found in all the water samples however, water from forest land use contained minimum FC with its average number of 4 MPN/100ml. Surface water from forest land use can be used for drinking water purpose with mild treatments for FC. Considering the concentration of plant nutrients, runoff water from other land uses was found to be good for irrigation and fish rearing. Harvested water needs to be treated with lime to reduce the pH.

KEY WORDS : Hilly watershed, Land use, Standards for drinking water, Surface runoff, Water quality

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Meghalaya receives average annual rainfall of about 1900 mm but scarcity of water for human and livestock consumption is severely felt during winter period. Perennial and seasonal streams are the lifeline of the rural tribal population of the state. Therefore, level of presence of pollutants in the surface water assumes significant importance for deciding the extent of pollution or degradation of water environment. When sources of water pollution are enumerated, agriculture has been identified as a major contributor of non-point source of pollution of water resources. Agricultural pollutants (such as sediment, fertilizers, pesticides, salts or trace elements) resulting from various agricultural activities cause the degradation of surface and groundwater resources through soil erosion, chemical runoff, and leaching (Corbett *et al*., 1997; Thorburn *et al*., 2003). The quality of surface water will be modified by many factors such as its flow regime, climatic conditions, pH, land use practices, and topography of the catchments in addition to the various human interventions in the basin (Meybeck *et al*., 1990). In Meghalaya the main source of protected water supply is streams, which passes through different land uses along the hill slope, the quality of which depends upon the concentration of inorganic and organic constituents generated by natural as well as anthropogenic activities. Increase in