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Sustainable use of groundwater resources: A case study of spring and gravity water in River Gucha-Migori catchment, Western Kenya

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River Gucha-Migori is located in Western Kenya, Lake Victoria basin of East Africa. The river Gucha-Migori catchment is characterized by high altitude areas with steep slopes in its headwaters. High population densities of over 698 persons per km2 have enormous pressure on existing water resources in terms of high demands for various uses. The area's population depends on spring water, gravity water, rain water, river/stream water and boreholes for various uses. The residents of the area heavily rely on spring water sources for drinking water demand. Due to land use activities, this source of water is under threat due to reduced recharge during the dry season. Steep slopes also make it difficult to collect water for daily uses which is mainly done by women and children. The spring water is also threatened by the growth of eucalyptus trees whose evapo-transpiration rates are high in comparison to other plant species. This reduces water level in the springs especially during the dry season. Intensive cultivation to meet food demands for the high population has contributed to deforestation and land degradation pushing people to cultivate on steep slopes. The result has been increased soil erosion that contributes to high sediment loadings in springs and even changes the colour to levels unpleasant to the communities. The spring water source faces a number of challenges that need to be addressed to ensure sustainable use of water resources within the catchment. One of the interesting aspects of the ground water sources is gravity water where water is channeled in pipes where it flows down stream. The water is tapped at different points where people collect the water to meet their various daily demands. This supply has numerous advantages such as it reduces congestion in water sources and also reduces distances to water sources to collect water. However it also faces a number of challenges that need to be addressed for its sustainable use. This paper will address the various issues related to the water resources and will suggest remedial measures for sustainable use and management in the study area.

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Materials science for alternative green energy technology

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With depletion as well as price rise of hydrocarbon fuels and to fulfill the continuously increasing energy demand, major attention is focused on hydroelectricity which resulted huge pressure on rivers. The large scale hydroelectric projects reduce the flow of rivers which results in increasing pollution level in water. The modern life style and excessive use of fossil fuel based energy also resulted in several environmental issues such as global warming, acid rain, increase level of poisonous gases in atmosphere. These issues are further participating in water pollution and causing danger to water or river ecology. Thus the development of clean, green energy alternatives is important not to curb only energy crisis but to save global environment and water ecology. In Professor John B. Goodenough` Group, we are engaged in developing clean energy alternatives and energy storage systems. Professor Goodenough has developed current generation of Li-ion battery technology which enables long battery life and utilization in current generation of electronic devices and now research is focus on providing clean, exhaust free, green energy alternative for automobile and as small scale power station. Currently solid oxide fuel cells (SOFCs) are considered as more efficient clean energy alternatives to meet global energy and environmental challenges. The current materials development and technological improvement in realizing more energy efficient and economical SOFCs will be discussed in this presentation and also future roadmap of coupling of bio-gas (gobar-gas) with SOFCs to make small scale power stations in village level will be also discussed.

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