Impact of Land Use Change on Hydrology and Hydropower Production: A Case of Kulekhani Project, Nepal

by

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Abstract

Natural land has been disturbed by human activities in most of the places in the world, so has been the major issue Nepal. Hydropowers are one of the most affected services due to land use change in upland catchment. This study has tried to quantify basin flow and sediment yield due to land use changes and consequent effect on hydropower production and its revenue. In this study possible future land use change scenarios for conversion of forest, agriculture and barren land were developed by past trends. Hydrological model SWAT was developed for the simulating land use change scenarios. Model result for flow then simulated in reservoir simulation model, Hec-ResSim to obtained power output. Power outputs and revenue for scenarios were compared with the present cases.

Land use change by forest depletion with agricultural expansion has increased average annual flow and average annual sediment yield. Similar result was obtained for forest land converted to barren land. For increasing forest land over agriculture land has decreased both average annual flow and sediment yield. Seasonal flow has substantially increased during wet season (Jun-Sep) and decreased during dry season (Oct-May). Whereas, seasonal flow during both wet and dry season are reduced by agricultural land conversion to forest land. Similar results were resulted for sediment yield as well. Average annual power production has increased for the increased average annual flow and reduced for decreased annual flow. Sediment deposition in the reservoir has very less influence for the changed land use pattern. Further, there will be higher hydropower output revenue for increased annual flow due to forest decreasing and lesser revenue for forest increasing scenario.

Excessive high flows and high sediment yield during wet season can bring problem of flooding and sediment deposition in reservoir. Whereas, low flows in dry season can increase water scarcity. In both of the cases, power production may cause obstruction. Despite higher average annual revenue for forest decreasing scenarios, watershed management is recommended to avoid undesired power interruptions and to maintain constant supply. This can leads to maintain continuous power supply during all seasons as per requirements.

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