

Using Heat as a Tracer to Estimate Streambed Water Exchanges beneath the Losing Disconnected Stream

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Streambed water exchanges is the movement of water from a river into the beneath sediments and then back into the river. This interaction between river and streambed is considered as a fundamental role in the functioning of riparian ecosystems. Chichiawan Watershed located in central Taiwan is the only habitat for the endangered species of formosan land-locked salmon and such dynamics of downwelling/upwelling flow within the streambed can affect the survival of salmon. In order to investigate the interaction between river and streambed, heat is used as an environmental tracer to determine the water exchanges within the streambed and estimate the hydraulic conductivity of sediments. The detailed hydrographs, thermographs, and vertical temperature profiles obtained along the Yusheng Creek, a tributary at the upstream of Chichiawan Creek, were presented and used to estimate the streambed water exchanges. Results showed that the Yusheng Creek along the monitoring section is a losing stream and its downwelling flux increases from up- to down-stream. Partial monitoring sections changed from perennial to intermittence when the consecutive dry days over a period of time increase significantly and an unsaturated zone between the creek and the groundwater existed. According to the measured temperature and water level data, the numerical model of VS2DH was used to quantify the vertical fluxes and hydraulic conductivities of streambed. The potential mechanisms causing the creek transited from perennial to intermittence and becoming a losing disconnected system need further study.