

# WESTERN NEPAL ENVIRONMENTAL FLOW CALCULATOR (WENEFC)

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## CHALLENGE

Many rivers in Nepal are relatively unregulated but have much untapped potential for hydropower development with associated economic gains. The rivers also serve a number of other purposes – supporting livelihoods and meeting the social and cultural needs of riparian communities. When a river's water resources are used for various purposes, it is often not realistic to maintain its natural flow regime. Therefore, a compromise has to be reached between satisfying human demands for economically important uses of water, maintaining the ecological health of a river, and satisfying communities' livelihood, social and cultural needs. Environmental flow estimation tools help make this compromise in a scientifically sound manner.

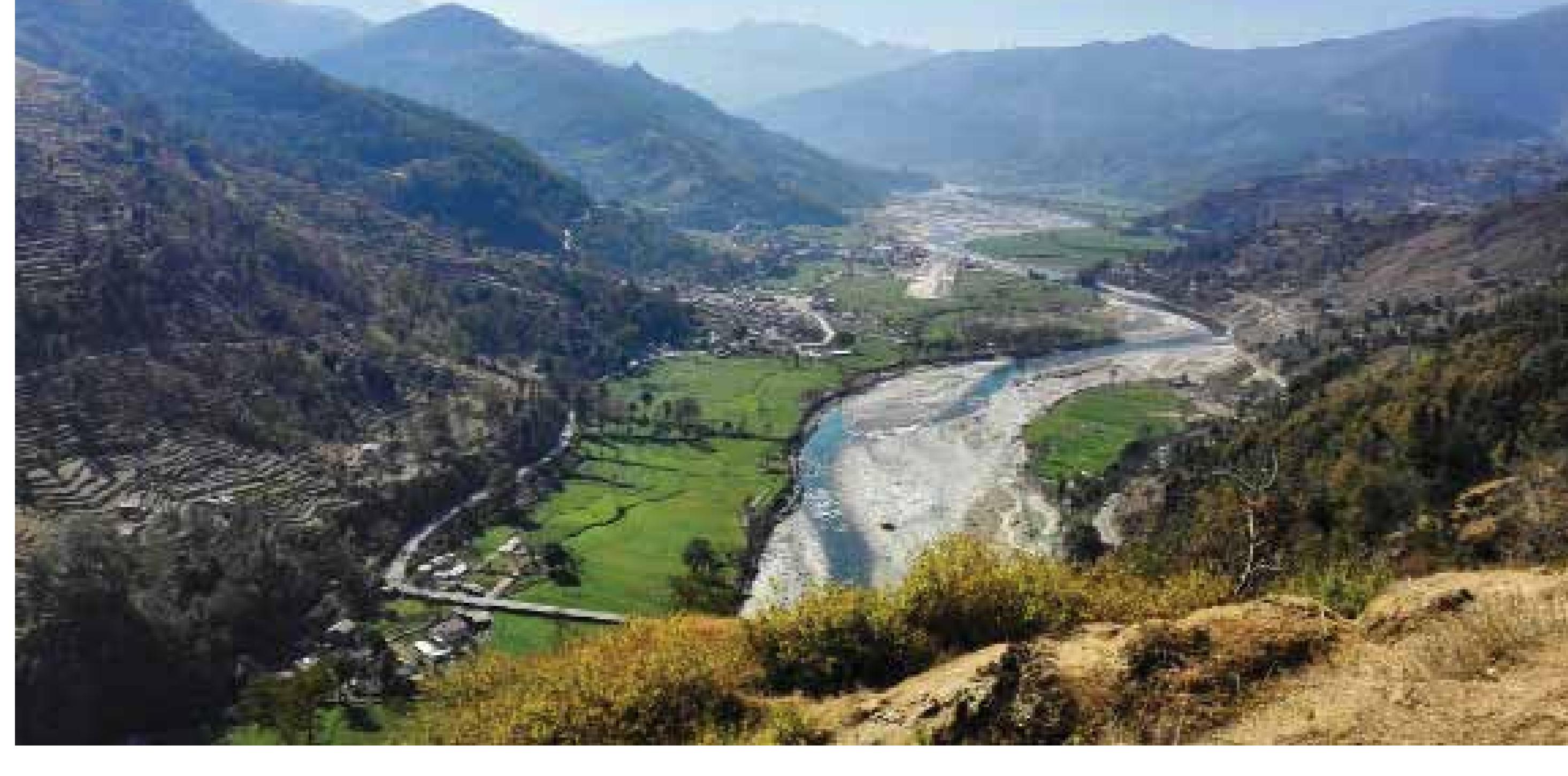


## RESEARCH APPROACH

The Western Nepal Environmental Flow Calculator (WENEFC) is a software package for desktop assessment of Environmental Flows (EF) of the Karnali-Mohana and Mahakali Rivers in Western Nepal. It was developed by incorporating simulated monthly flow values at 157 locations on both rivers. The simulated flows are outputs of Soil and Water Assessment Tool (SWAT) hydrological models. Two methods were developed to estimate EF, the Hydrological Method based only on hydrological considerations and the Holistic Method based on hydrology as well as ecology and socio-cultural considerations. The Hydrological method follows the procedure developed by Smakhtin and Anputhas (2006), whereas the Holistic method is based on results from ecological and social surveys conducted under the DJB project. Both Hydrological and Holistic Methods estimate EF requirements to maintain the rivers in different management categories, ranging from "pristine" to "highly modified."

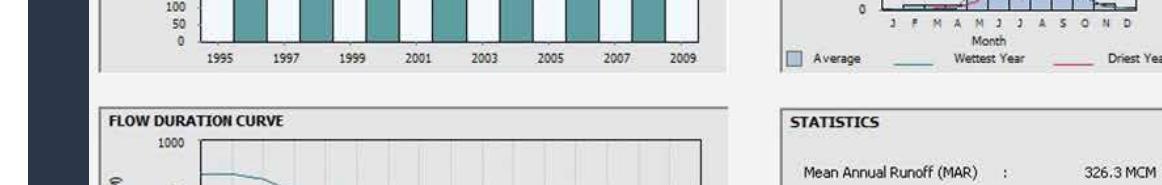
## INSIGHTS & INNOVATIONS

This is the first EF assessment tool for Western Nepal. The ecological survey provided new insights into the intricate relationships between river flow and macro-invertebrate richness and abundance in the upstream reaches of the Karnali-Mohana and Mahakali Rivers. Social surveys helped to understand riparian communities' degree of dependence on river flow for their livelihoods and socio-cultural needs. This is the first time that ecological, social and cultural requirements have been linked with hydrology to estimate EF in Western Nepal. Advantages of the WENEFC are its user-friendly map-based interface, ease of extracting flow data by selecting locations on the map, and its ability to provide quick estimates of EF. In addition to using the built-in flow data to understand environmental flow requirements at specific sites within the two river systems, users can input their own flow data into the calculator and obtain EF estimates.



## NEXT STEPS

WENEFC can be used for environmental impact assessments and water infrastructure planning to define the quantity and timing of water flows required to sustain river biodiversity, ecosystem services and livelihoods. This is the first step in a continuous process to provide a simple user-friendly tool for rapid analysis of environmental flow requirements for Western Nepal, before any major water resources development projects are initiated in the region. There is ample scope for improving the calculator by extending the ecological surveys to larger segments of the Karnali-Mohana and Mahakali Rivers, and conducting workshops with expert groups to verify and expand the relationships between river flow and ecosystems, livelihoods, society and culture. These steps would enable the WENEFC to make better estimates of EF requirements.



Map showing the location of the study area in Western Nepal.