Supporting integrated water resources management in the Koshi Basin, and beyond

Through its own water reform journey, Australia has learnt many water management lessons that are universally applicable. These include the need to have agreement on the amount of water that is available, the demands that are made on it, and how it can be best shared to ensure that the livelihoods of the people and ecosystems that it supports are sustained. CSIRO is working with Nepali organisations that are responsible for their own water reform journey, with the aim to assist in building the evidence base necessary to guide strategic investments in water resources development.

The Sustainable Development Investment Portfolio (SDIP) is an Australian government initiative with the goal of increasing water, food and energy security in South Asia, targeting the poorest and most vulnerable, particularly women and girls. A key target sector is water resources management. Within the SDIP, preliminary research and development by CSIRO has focussed on understanding the biophysical, cultural and policy environments of the Koshi watershed of Nepal, and supporting capacity development activities within the Government of Nepal.

Quantifying the water resource

CSIRO is improving understanding of the water balance of the Koshi Basin catchments. CSIRO has supported revisions to rainfall station locations, development of new gridded rainfall products and refinement of hydrological models, all of which lead to better understanding of the timing and availability of water in major streams, including under projected changes to climate. In one catchment, the better spatial representation of rainfall led to the elimination of a spurious streamflow bias in the corresponding catchment runoff model.

Modelling the hydrological processes

Working with local modelling experts, we improved models of the Koshi basin hydrology. In addition to providing a quantitative representation of historical and current water resources, the model can be used to explore the likely water-related consequences of future development and climatic scenarios.

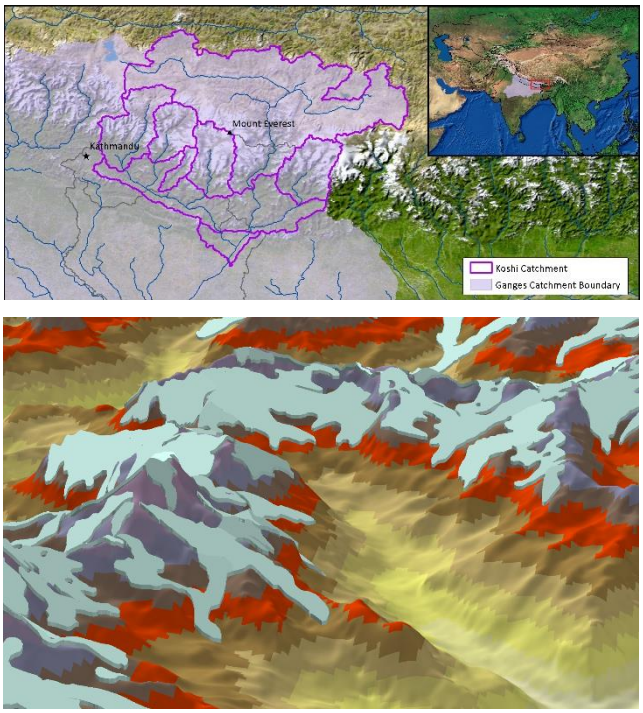

Figure 1 The Koshi Basin (and its sub-basins) and a 3D elevation view of its characterisation for modelling of hydrological processes

Improving rainfall and temperature patterns

Daily precipitation, minimum and maximum temperatures gridded datasets have been generated for the Koshi Basin. These are more accurate than existing products due to the improvements in locations of rainfall stations (providing better validation against observed data) and the use of sophisticated statistical methods. These datasets will be made publicly available in June 2016.

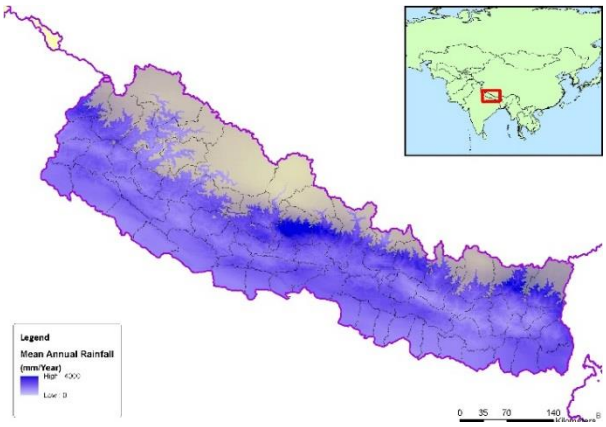

Figure 2 Mean annual rainfall (mm) surface

Describing river flow characteristics

Expert ecologists identified a lack of knowledge about current flow regimes, and how ecologically significant aspects may change under altered flow regimes. Using a suite of hydrological metrics (e.g. mean daily flow) to classify and cluster flow regimes, we can map these to look at their spatial distribution.

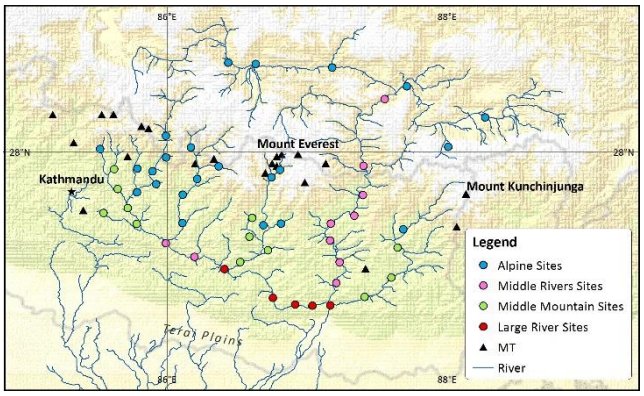

Figure 3 Spatial view of river flow clusters (differentiated by colour)

Livelihoods

We are working with local researchers to value-add on existing analyses of household livelihood strategies in the Koshi basin and in Nepal, using data from the Poverty and Vulnerability Assessment Tool (PVAT), a household survey data set undertaken by the International Centre for Mountain Development (ICIMOD). This work was presented to the 24-25 March 2016 workshop 'Water-livelihoods-gender nexus to advance Koshi Basin management' jointly organised by the Department of Irrigation and Department of Agriculture, Government of Nepal, hosted by ICIMOD and CSIRO.

Figure 4 Livelihoods of the Koshi Basin

Connecting flow and ecology

Nepali scientists have a deep understanding of how water moving through rivers and wetlands supports ecological species (e.g. birds, fish, macro-invertebrates), that is the river flow-ecology relationship. We are working with them to systematise this knowledge. The key benefit of understanding river flow-ecology relationships is that, when river flow changes occur, evidence is available to understand the likely impact on the ecosystems and livelihoods that it supports.

Companion report: Penton DJ, Neumann LE, Doody TM, Foran T, Grigg NJ, Zheng H, Cuddy SM, Dolk MM, Siddiqui S, Stratford D, Boudier E, Chua ST and Fleming DA (2016) Preliminary analysis of hydroclimate and streamflow modelling in the Koshi Basin: Climate, hydrology, ecology and institutional setting. Sustainable Development Investment Portfolio (SDIP) project. CSIRO, Australia. <https://publications.csiro.au/rpr/pub?pid=csiro:EP164390>

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