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Assessment of freshwater ecosystem services in the Beas and Sutlej River Basins, Himalayas region, India

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River systems provide diverse ecosystem services, such as flood regulation (regulating), fish (provisioning), nutrient cycling (supporting) and recreation (cultural) among others. Although development of water resources involving the construction of dams for hydropower or irrigation can enhance the delivery of one ecosystem service category (generally provisioning ecosystem services), such developments also alter the flow regime, causing reductions in less tangible regulating, cultural and supporting ecosystem services and leading to trade-offs between ecosystem service categories. This study seeks to understand how numerous impoundments, abstractions and transfers in the Sutlej and Beas river basins in the Himalayas region in India are affecting downstream supporting and cultural ecosystems and services. While approaches for assessing these are being developed, the immediate aim of this paper is to set out a framework for their quantification. The proposed framework utilises a combination of methods which include field surveys of river reaches to assess the diversity of species and habitats, historical data analysis, stakeholder interviews and statistical modelling to assess how altered river flows impact on the delivery of downstream ecosystem services. Such a framework takes into account stakeholder views in capturing cultural and less tangible ecosystem services from a river system – allowing for consideration of the full suite of ecosystem services in ecosystem service trade off assessments and decision making. Knowledge of changes in ecosystem service delivery and associated trade-offs linked to development of water resources in river systems, from past to present, will help inform current and future water resources management strategies.

Key words: ecosystem services, water resources, trade-offs, river systems, flow regime, freshwater