Development of Representative Indicators of Hydrological Alteration Using Principal Component Analysis

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To study the impact of river regulation due to dams and to design optimal reservoir operation policies, hydrologic indicators, which describe the overall health of the river and the degree of hydrological alteration caused by a particular reservoir operation policy, are needed. Currently over 170 hydrologic indicators have been recommended to describe various aspects of streamflow regimes. One example is the Indicators of Hydrological Alteration (IHA), which is a set of 33 commonly used indicators for characterizing the impact of regulation on the flow regimes. Many of these indicators are correlated, creating a redundancy of information and difficulty interpreting these indicators and managing flows. Hence, there is an increasing need to develop a smaller set of independent, representative indicators. The objective of this research is to develop a small set of representative hydrologic indicators that best characterize hydrologic alteration caused by dams. A set of simulated streamflow data generated from Water Evaluation And Planning (WEAP) and a set of real pre- and post-dam streamflow data measured at 191 US Geological Survey gages are used in this research. Principal component analysis (PCA) is performed to evaluate the ability of the proposed hydrologic indicators to represent the complete variability of the IHA parameters. Preliminary results of the PCA indicate that Ecodeficit and Ecosurplus, which are areas between the pre- and post-impact flow duration curves of a site, are

good candidates of such hydrologic indicators.