

Electricity vs Ecosystems – understanding and predicting hydropower impact on Swedish river flow

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Abstract The most radical anthropogenic impact on water systems in Sweden originates from the years 1900–1970, when the electricity network was developed in the country and almost all rivers were regulated. The construction of dams and changes in water flow caused problems for ecosystems. Therefore, when implementing the EU Water Framework Directive (WFD) hydro-morphological indicators and targets were developed for rivers and lakes to achieve good ecological potential. The hydrological regime is one such indicator. To understand the change in flow regime we quantified the hydropower impact on river flow across Sweden by using the S-HYPE model and observations. The results show that the average redistribution of water during a year due to regulation is 19% for the total discharge from Sweden. A distinct impact was found in seasonal flow patterns and flow duration curves. Moreover, we quantified the model skills in predicting hydropower impact on flow. The median NSE for simulating change in flow regime was 0.71 for eight dams studied. Results from the spatially distributed model are available for 37 000 sub-basins across the country, and will be used by the Swedish water authorities for reporting hydro-morphological indicators to the EU and for guiding the allocation of river restoration measures.

Key words hydrological regime; change; regulation; dams; naturalized, model skills; multi-basin; S-HYPE