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Trade off relationships: incorporating ecosystem spatial scale and timing issues into the decision making process

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In large hydropower-dominated river basins, reservoirs are mainly operated so as to maximize revenues from energy generation regardless of the consequences of reduced flow fluctuation on downstream ecosystems. Revenue from hydropower plants is essential to a country's economy; however the impact on ecosystems downstream can be large-scale. The timing of flow releases does not mimic natural systems, which has impacts over different temporal and physio-spatial scales to the ecosystem. To inform decision making often hydro-economic modeling is used and it is essential that the response of the system is understood and incorporated adequately into assessment design, to allow for trade-offs to be identified. This requires issues of timing and spatial scale to be understood and incorporated over different planning horizons. Nesting these issues of scale into decisions is complex; where decisions are made on timescales from hours to months and spatially within a basin depending on the operation of the system. Up-scaling the most critical interactions between flow, form and ecosystem into the decision making process, for different time horizons or planning scales, is essential. A proposed framework is illustrated with the Zambezi basin.