

Managing water quality for climate change - modelling the Saskatchewan prairies

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The river-reservoir networks of the Saskatchewan Prairies are the powerhouses of water supply in the province. This is especially true across the heavily farmed semi-arid grasslands of central and south Saskatchewan. Climate change and growing irrigation demands will impact available water quality and quantity in the coming decades. Future climate data (CMIP6) suggest mean air temperatures will increase steadily in the region with expected increases in evapotranspiration and degradation of water quality, such as algal blooms. Over the GWF program water quality models have been applied to strategic rivers and reservoirs crossing the Saskatchewan Prairies. Both CE-QUAL-W2 and WASP have been applied to investigate water quality in Lake Diefenbaker, the South Saskatchewan and Upper Qu'Appelle Rivers, and Buffalo Pound Lake. These models have investigated impacts on water quality from projected changes in climate, increased water demand, water management transfers, catchment runoff, and metals and sediment transport. To synthesise the research to date, these models will be combined in a loosely coupled system for climate change analysis. The loose coupling reflects that water quality in these waterbodies will be influenced by their connected boundary conditions. Future flow data will be taken from the MESH model and accounts for sizable, planned irrigation projects around Lake Diefenbaker. Incorporating these flows, water quality output from the Lake Diefenbaker model will then provide the boundary conditions for the downstream models. Modelling work in the Lake Diefenbaker-South Saskatchewan system will concentrate on the transport of sediments and metals, and the replenishment of sediments to the Saskatchewan River Delta. Modelling work in the Lake Diefenbaker-Qu'Appelle system will centre on future water quality in the downstream eutrophic reservoir Buffalo Pound Lake. This reservoir provides the water demands for approximately 25% of the Saskatchewan population, and this work is designed in discussion with the Saskatchewan Water Security Agency (WSA). Scenarios test the impact of interbasin water transfers on the water quality of Buffalo Pound after periods of heavy catchment runoff. Of interest is whether these transfers may be managed to counteract potential degradation of water quality due to climate change. As the provincial water management agency, the WSA has been provided with the opportunity to refine the scope of the model development and scenarios to address pertinent questions about water diversion strategy. The result is a model that satisfies both stakeholder and scientific objectives.