Long-term water security: an approach for systemic analysis of urban water supply

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Introduction

The impact of hydrological drought trends around the world over the 21st century can trigger temporary reductions in water availability, often leading to water shortages in urban water supply systems. This problem becomes more challenging if the long-term socio-economic vulnerability and damage to ecosystems are taken into account [1].

This research aims to develop a generic system dynamic model for identifying plausible long-term trends for water supply systems under the effects of external drivers.

A systemic approach is applied to reservoir operational policies of one of the largest water reservoirs in the world, the Cantareira system, which serves the Metropolitan Area of São Paulo (MASP).

The Metropolitan Area of São Paulo

Located approximately 600 km southwest of Rio de Janeiro and 80 km inland from the Atlantic Ocean (Figure 1), the Metropolitan Area of São Paulo is the largest urban concentration in South America. It is one of the 10th largest urban areas in the world, where live about 20 million people, 60% in the city of São Paulo [2, 3].

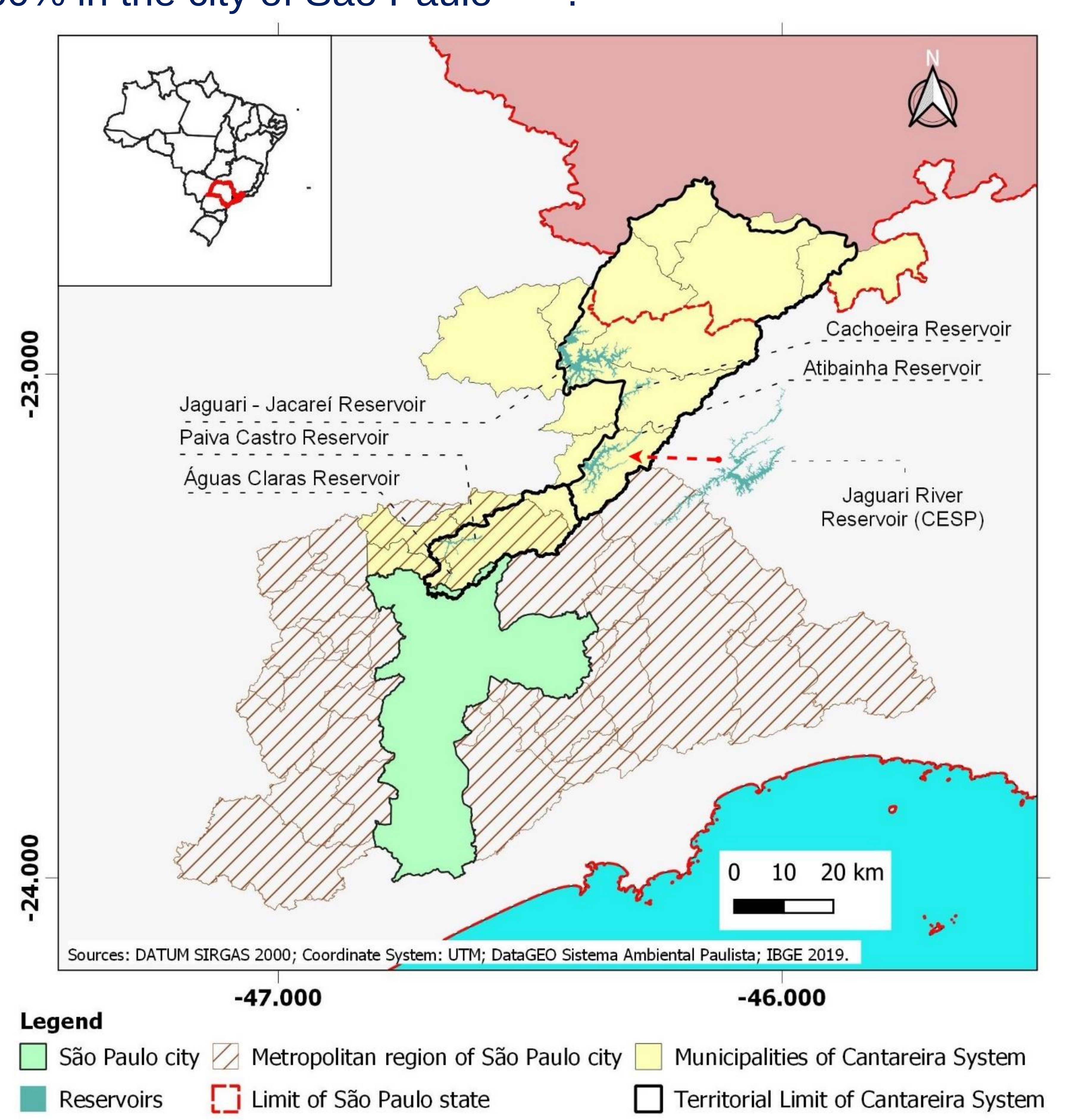

Figure 1. The study area. (the red arrow represents the water transfer between the Cantareira system and Jaguari reservoir.

Model development

Figure 2 represents the description of the reservoir system.

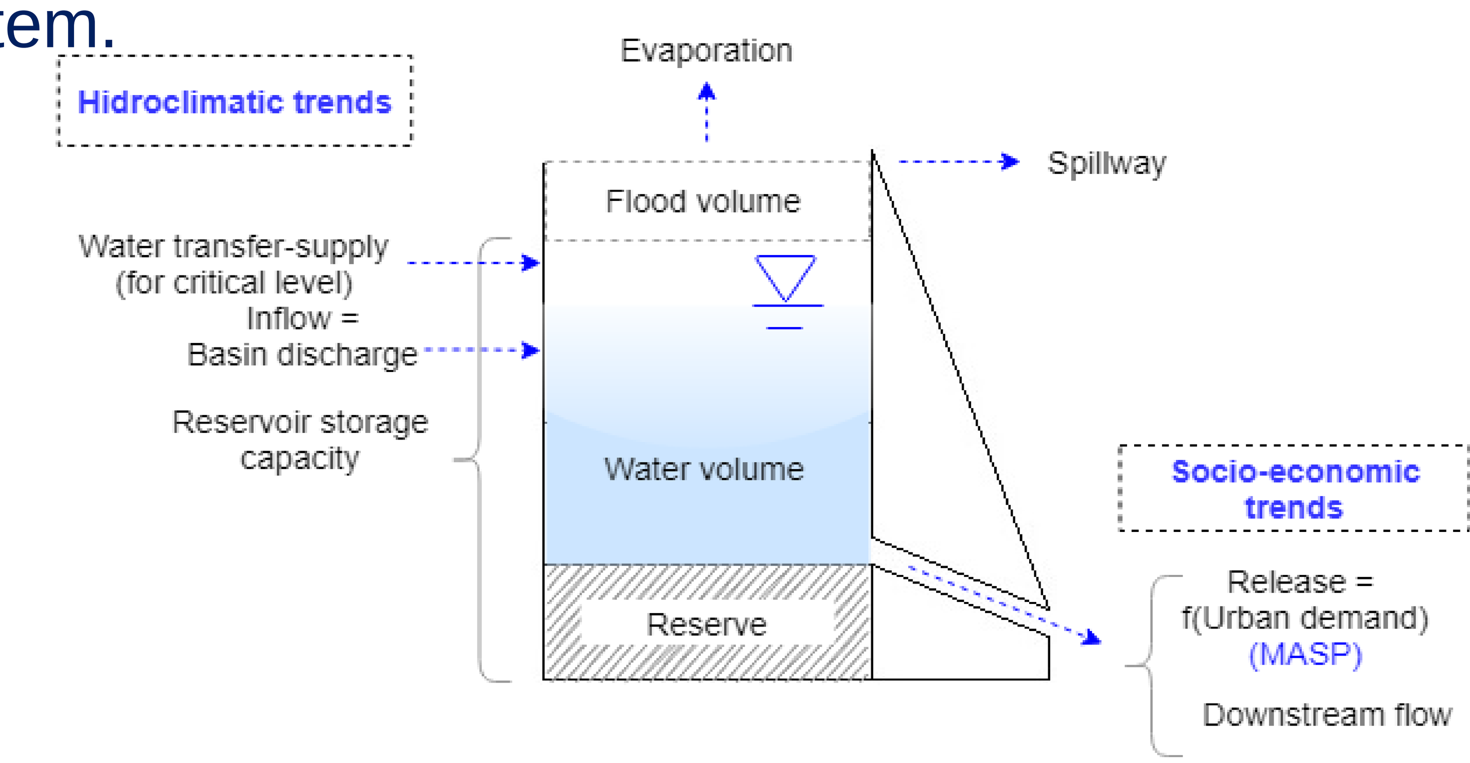

Figure 2. Conceptual model of a single reservoir.

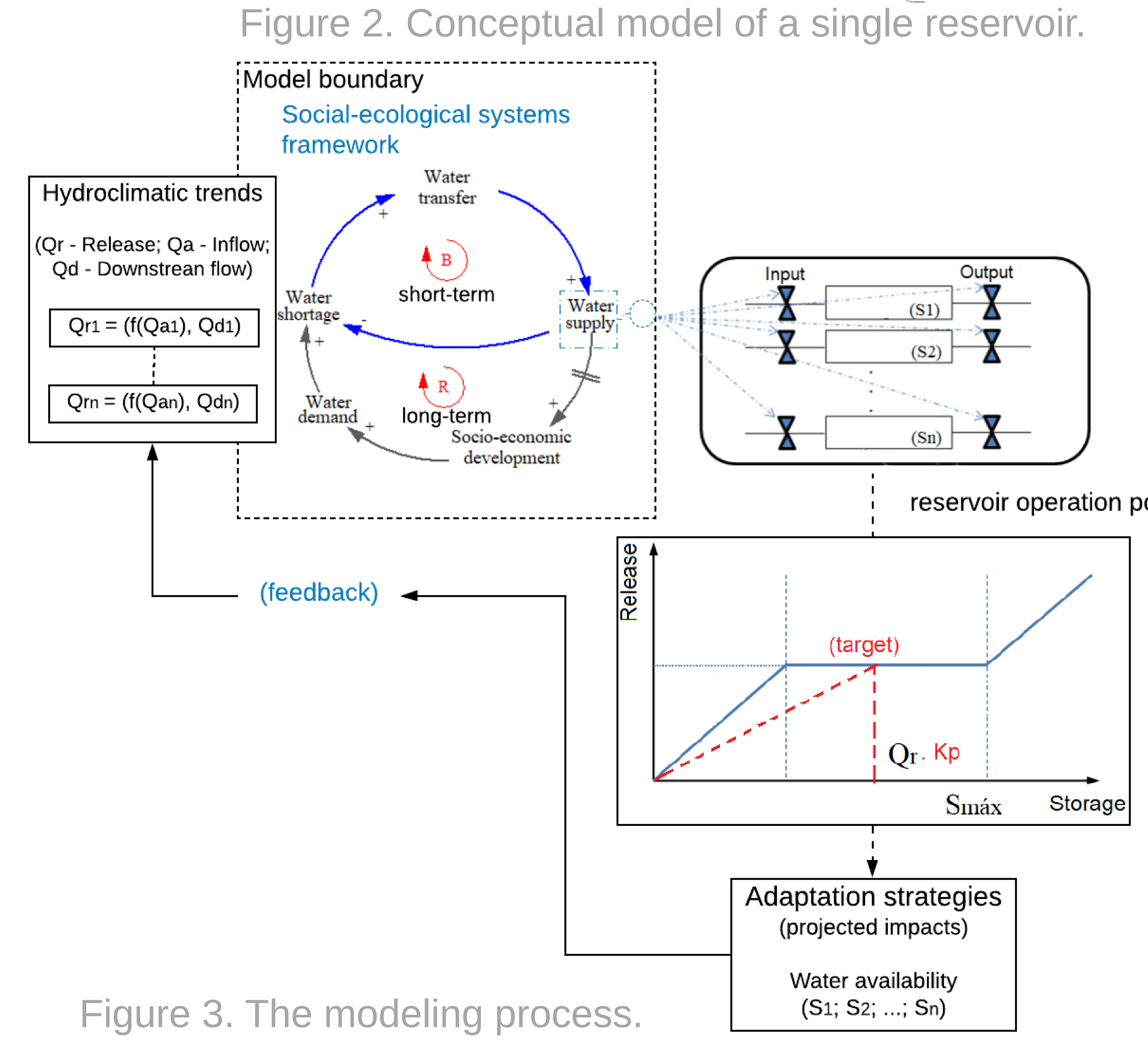

Figure 3. The modeling process.

A Socio-ecological framework [4] is applied in the analysis of hidroclimatic trends accomplished by choosing a trigger value of reduction demand, Kp (Figure 3, and 4).

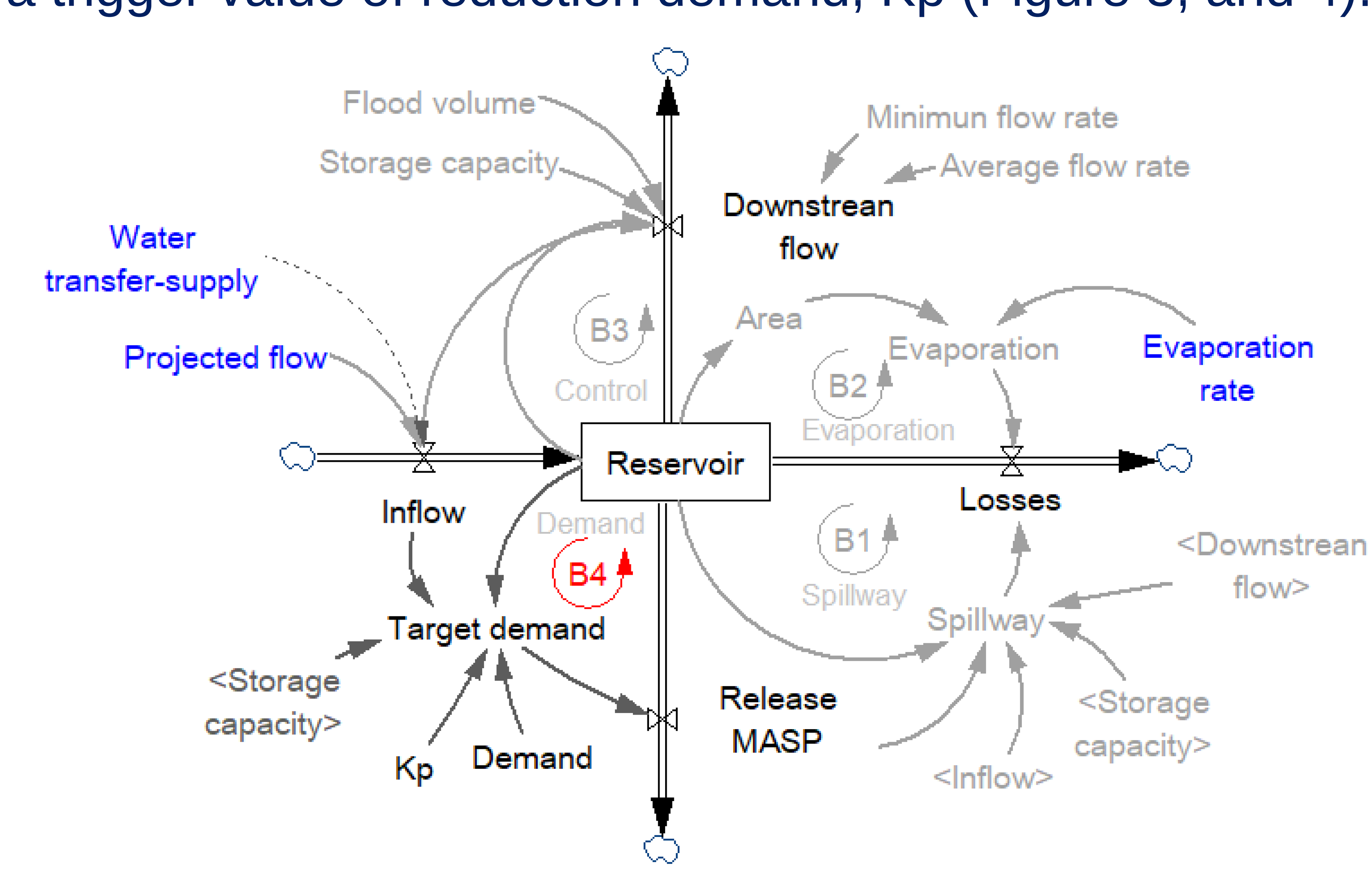

Figure 4. The reservoir model.

Expected Contribution

The main output is trigger value (Kp times the period's demand) in which the demand target gradually declining, with the projected reservoir contents under changing climatic effects. These water restrictions may be required to develop a model tariff adjustment at the whole system level.

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