



Drought and reservoirs: intended benefits and unintended consequences

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Socioeconomic drought can be broadly defined as a condition whereby water demand cannot be satisfied by water supply. Here we posit that while reservoirs often alleviate socioeconomic drought, they can lead to unintended consequences in the medium-long term.

Losses caused by socioeconomic drought tend to trigger public pressure for action, which can result in the introduction or expansion of reservoirs to store more water during high flow conditions, and release it during low flow conditions. In the short term, increasing reservoir storage is often beneficial because frequency, magnitude, and duration of drought can be significantly reduced. Yet, it is important to note that reservoirs may fail in mitigating major, prolonged drought, because reservoir storage is unavoidably limited.

In the medium-long term, two main dynamics tend to emerge, which often generate unintended consequences. The first one, termed here as “supply-demand cycle”, is when increasing water supply triggers additional development and thus generates higher demand, which then offsets the benefit of reservoirs as a water supply source. This is a self-reinforcing feedback, or vicious cycle, as the occurrence of a new socioeconomic drought will then likely trigger further expansion of reservoir storage to, again, increase water supply. A second dynamic, termed here as “reservoir effect” (after White’s “levee effect”), is when extended periods of abundant water supply, secured by reservoirs, generate a decline of coping capacities through increased competition for water and reduced shocks to the system, which in turn increases the vulnerability of the system to socio-economic drought. In other words, while a frequent experience of water shortages can help keep high levels of preparedness, some elements of system’s resilience can be lost when minor-to-moderate events are avoided. As a result, the development of reservoirs can generate a shift from frequent socioeconomic drought conditions to rare-but-potentially-catastrophic disasters.

This presentation critically discusses real world observations of the above dynamics by referring to empirical evidence reported in the scientific literature, as well as various case studies from around the world.