

# Resilient Flow Regimes in the Rio Grande – Río Bravo Basin

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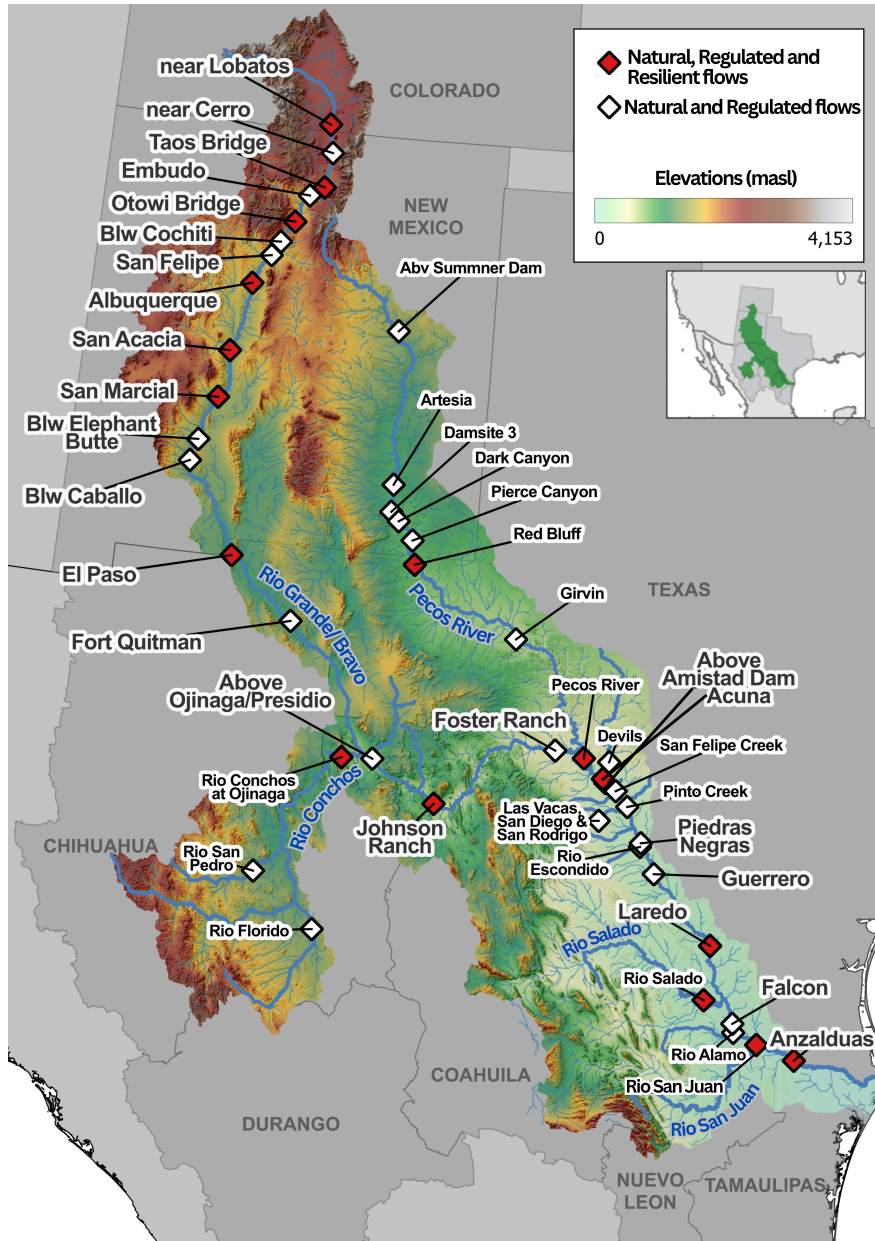
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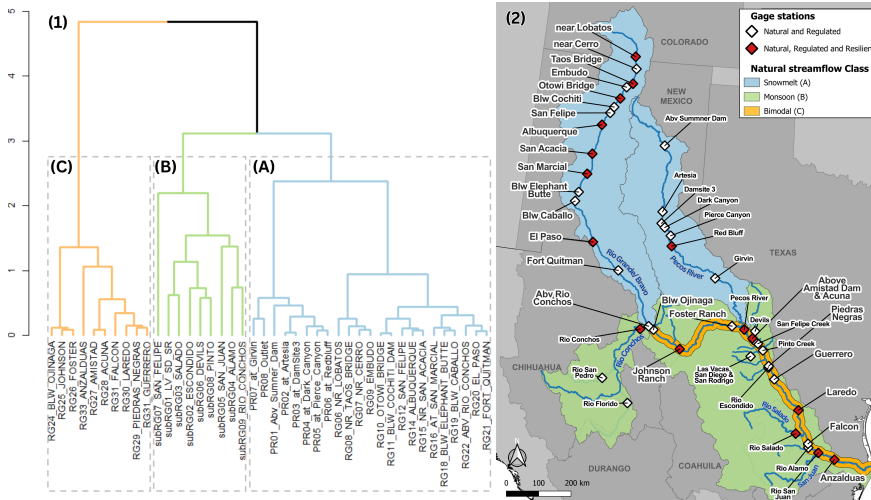
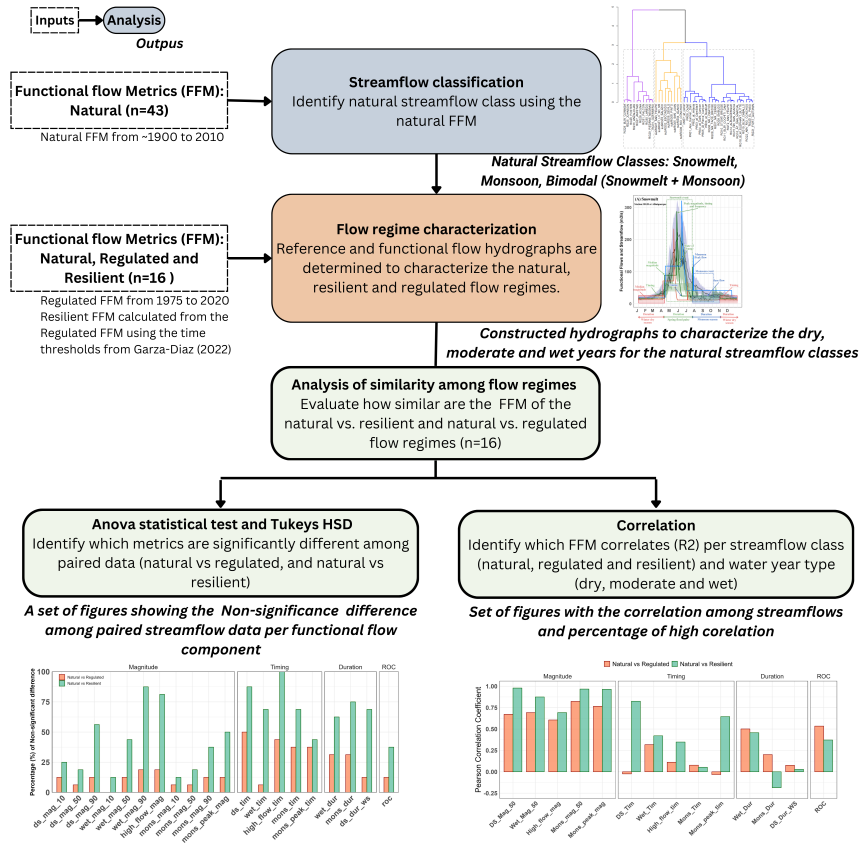
## Abstract

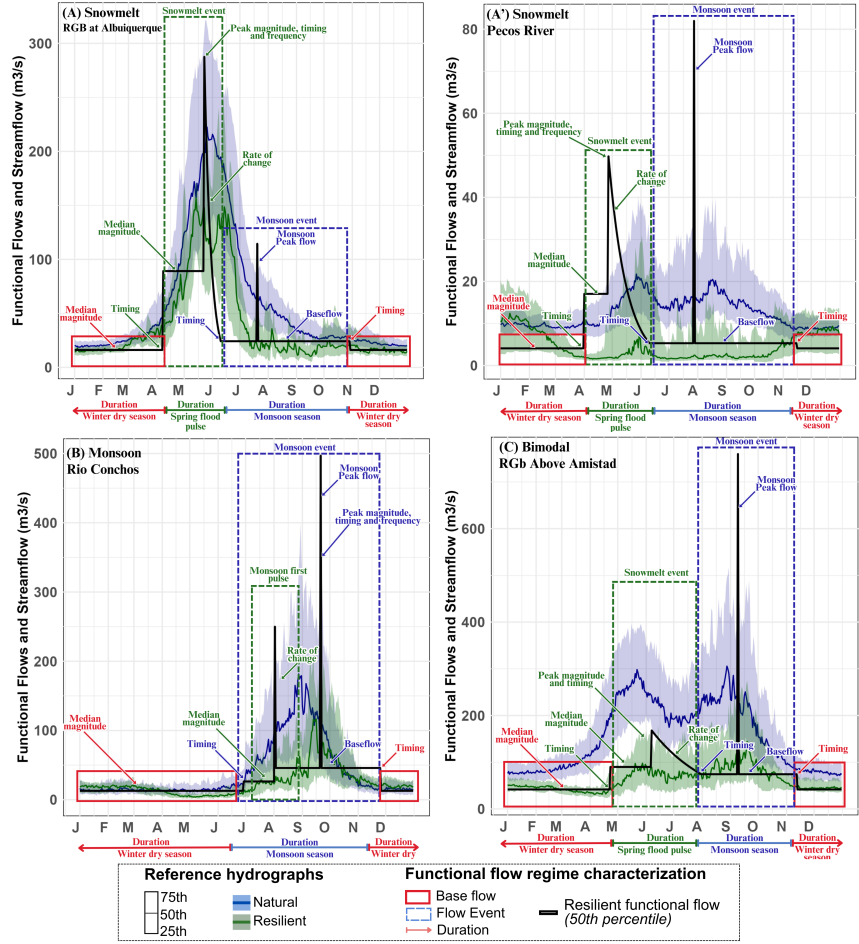
Water is essential for human development and is an indispensable resource for any economic activity and country's development. However, current water practices, increasing land-use change, climate change, and agriculture practices have significantly altered the hydrological cycle and water availability. This study defines the concept of a *resilient flow regime*—a flow regime that absorbs some perturbation by human alterations but still preserves ecologically beneficial characteristics associated with the natural flow regime—and its implications for sustainable water management. Using the Rio Grande/Bravo (RGB) basin as a case study, the research evaluates the similarities and differences between natural, resilient, and regulated flow regimes. The RGB, a transboundary basin shared by the U.S. and Mexico, faces significant water resource challenges due to extensive infrastructure development, water overuse, and climate variability. The study identifies three natural streamflow classes in the RGB—snowmelt-driven, Monsoon-driven, and Bimodal—and evaluates functional flow metrics across 16 gage stations. Results indicate strong correlations between natural and resilient flow metrics, particularly for magnitude components, whereas regulated flows show greater differences from natural conditions. Statistical analyses show that resilient flow regimes maintain ecological functionality and hydrological integrity, balancing human water needs and ecosystem health. By maintaining or restoring resilient flow conditions, water management strategies can mitigate adverse impacts of human activities, preserve biodiversity, and enhance the long-term sustainability of riparian ecosystems. This research provides a framework for integrating ecological considerations into water management practices, addressing the challenges of climate change, population growth, and increasing water demands.

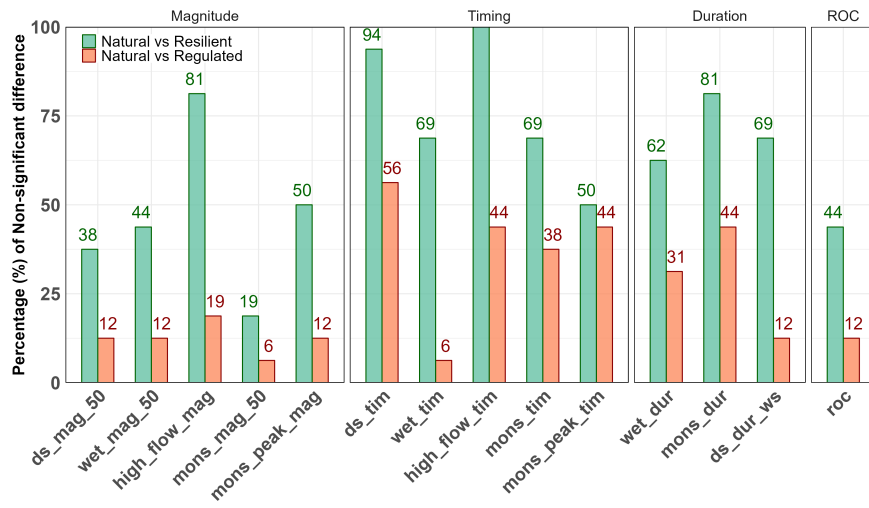
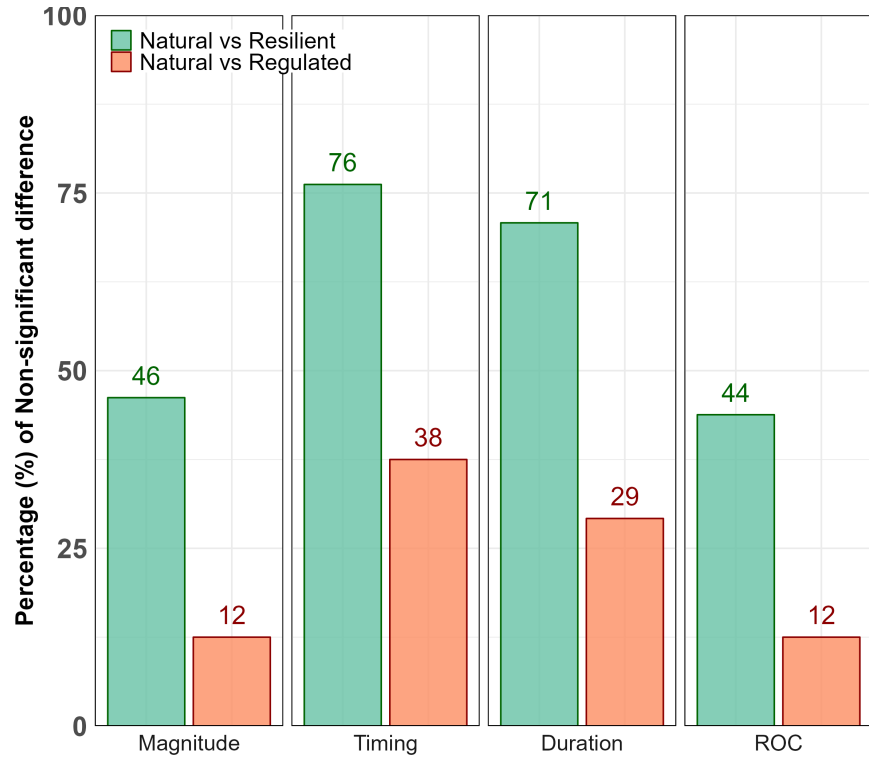
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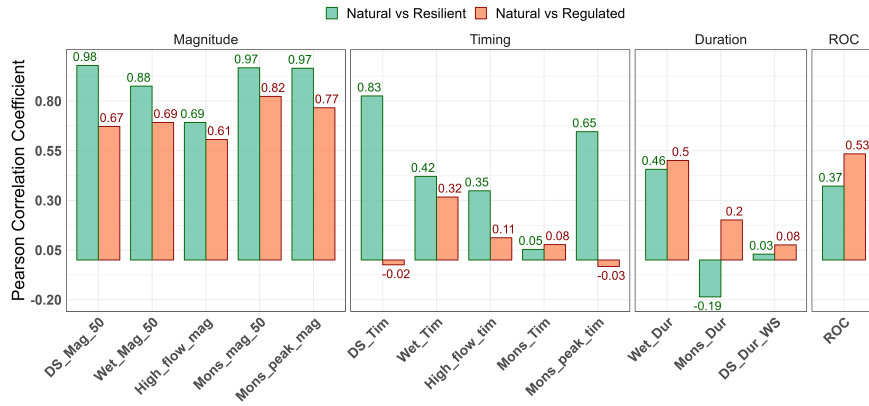
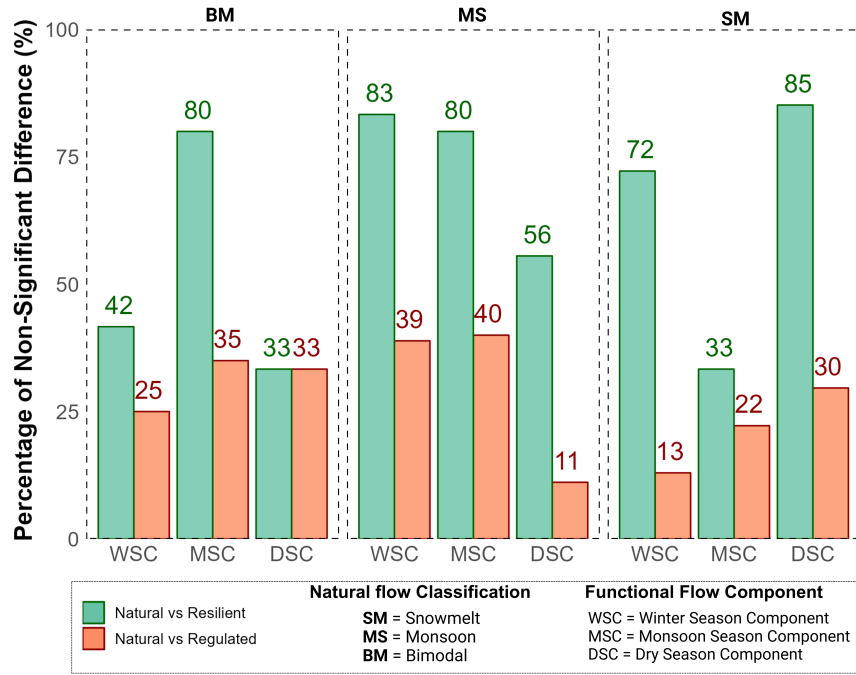
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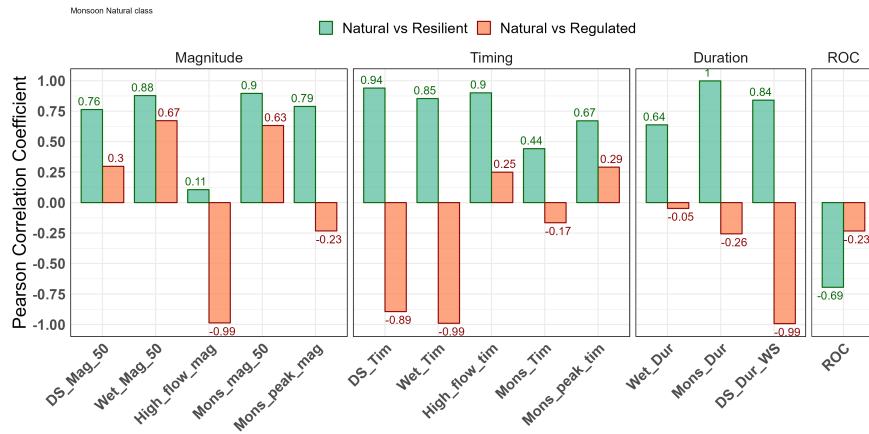
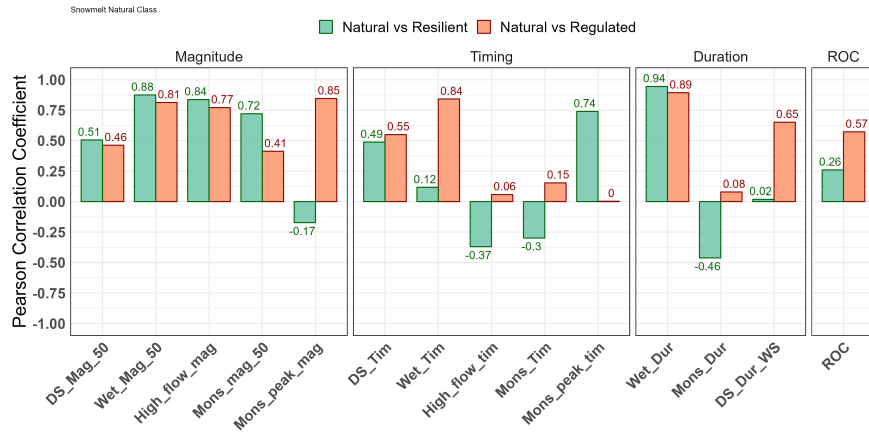
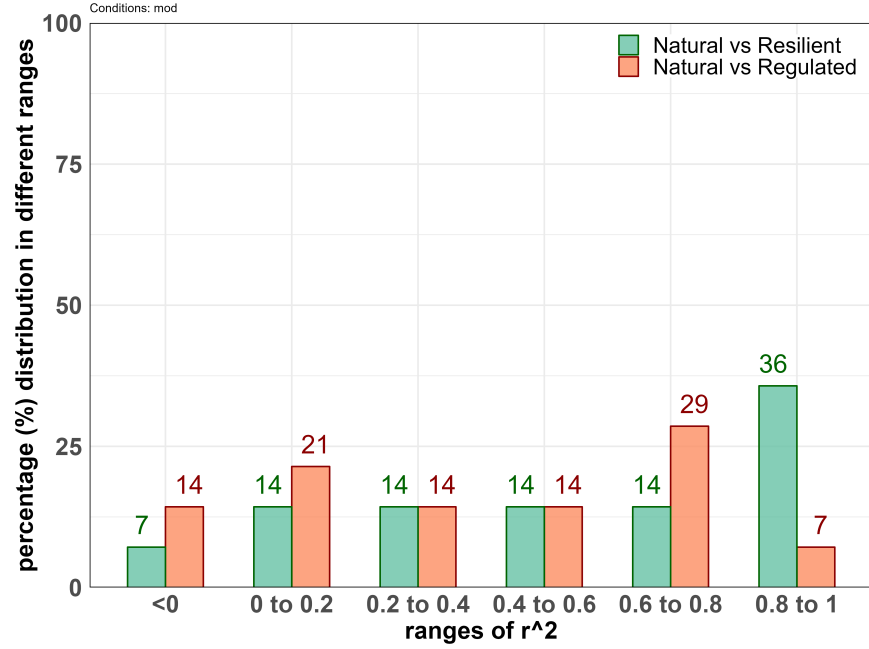


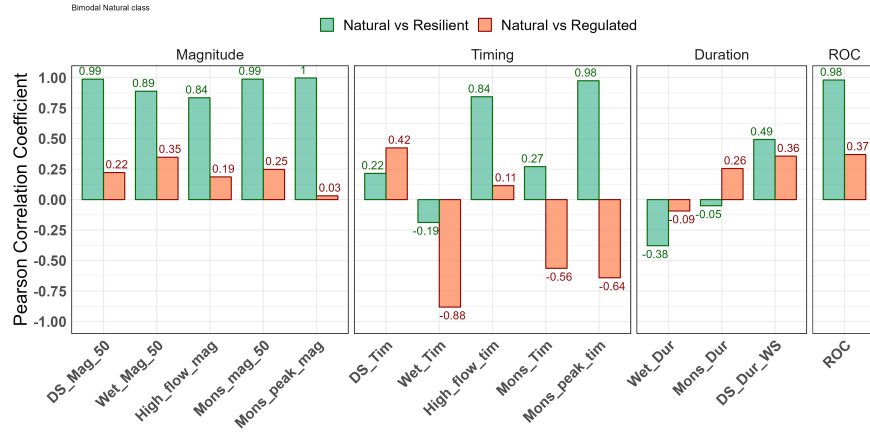












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