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Assessing Green and Blue Water under Changing Environment: Understanding Interactions and Making Balance between Humankind and Nature

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Water resources assessment is crucial for water management for resilience against water scarcity under the changing environment. Assessments by considering both the blue and green water are of great significance as the green water plays a critical role in the terrestrial ecosystem, especially in arid and semi-arid regions. Many approaches and frameworks are developed for green and blue water valuation, while few of them considers the interrelationship between green and blue water. This study proposed a new framework for green and blue water assessment by considering the interaction between them in an arid endorheic river basin in China where hydrological cycling is dramatically altered by human activities. We found that the green water is the dominant water resources from precipitation in the study area and the green water coefficient is 0.86. In addition to the blue water resources from precipitation, there are a large amount of blue water from the upstream that charges the research domain and are accounted for 72.8% of total blue water. As a consequence of human influence, there is 82.6% of the blue water transformed to green water through irrigation and canal seepage. Water availability varies in time and space due to the precipitation variability, while water consumption differs for different ecosystems due to irrigation implementation, land use, and climate. In the study domain, 36% (10.8%) of the vegetation covered land requires more than 50% (75%) of water from blue water resources. These hotspots indicate areas at risk for freshwater use as a result of overconsumption of blue water, where human and nature might face increased conflicts and tensions over water resources due to the water competition between them. This study provides implications for water management aims to make the balance between humankind and nature.