Urban and Industrialized Watersheds Have Elevated Water Risk and Limited Opportunities to Mitigate Risk through Water Trading

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Abstract. Existing assessments of water stress, which focus on total water withdrawal/total water available, risk giving a false sense of security in regions where water is increasingly reallocated from agriculture to municipalities and industry (M&I). This is because M&I have a limited ability to adjust water use and are willing to pay (WTP) high prices for water during droughts. To account for the effect of demand elasticity and WTP on water risk, we calculate the ratio of high (M&I) to low (agriculture) WTP water withdrawals in all 204 watersheds in the contiguous US. This analysis of what we call water demand stress revealed that central and eastern watersheds are at greater risk than previous water stress assessments indicate. We tested this interpretation by showing that high water stress and water demand stress are associated with high water prices across 12 western states (data not available elsewhere). Using hydro-economic modeling, we then show how climate change and M&I demand growth may play out in one demand stressed river (77% M&I), the Brazos River, TX. We projected 3X increases in economic losses and 2X increases in water prices in the next 30 years. Critically, trading water from agriculture to M&I is insufficient during extreme droughts, leading to 6-10X price increases. With 40% of countries worldwide experiencing water demand stress (>1), this study provides a much needed approach to anticipate where future water prices may be high and where strategies beyond markets may be essential to reduce water risk.