Remote Sensing of Evapotranspiration to Assess Water Budget Response Across a Restoration Landscape

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Estimates of evapotranspiration (ET) are valuable for effective monitoring and management of water resources, as they represent the largest component of the water budget. In areas that lack a ground-based monitoring network, remote sensing allows for accurate and consistent estimates of ET across a broad scale. Several global-scale remote sensing ET products exist, though each single product has limitations (i.e., consistency, resolution, availability). We developed an Ensemble Mean product to incorporate advancements, reduce uncertainty, and extend our period of study. The Ensemble Mean ET product is applied to estimate vegetative water use and variations in response to restoration using natural infrastructure in dryland streams (i.e., check dams, leaky weirs) and management interventions (i.e., fencing pastures) on a private ranch in Baja California Sur, Mexico. We initiated a paired watershed study to compare a watershed being restored with a series of adjacent control watersheds. Specifically, we identify and develop a consistent monthly Ensemble Mean product using this suite of ET products, assess changes in ET using this product over time across multiple Land Use/Land Cover types, and evaluate differences in vegetation and ET response between treated and control watersheds. We found the Ensemble Mean ET product is more reliable than using a single ET data product and can augment the efficacy of ET-based studies, particularly in areas without a ground-based monitoring network. We observe that ET across grasslands/shrublands depends more on precipitation, while forest vegetation appears to be less responsive. When expanding these results across the restoration landscape, increasing vegetation greenness and ET occurs within the restored watershed when compared to control sites (ET Slope*1000: Restoration = 0.3; Control = 0.24), indicating that restoration was effective at increasing vegetation health and greenness. We attribute this to greater water available to plants r and a reduction in grazing in the restored watershed.

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