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Remotely Sensed Evapotranspiration in the Lower Colorado River Delta in Response to Environmental Pulse Flows

Pamela Nagler (1), Christopher Jarchow (1), Armando Barreto Munez (2), and Kamel Didan (2)

(1) U. S. Geological Survey, Southwest Biological Science Center, Tucson, AZ, United States (pnagler@usgs.gov), (2) Agricultural and Biosystems Engineering of The University of Arizona, 1177 E. 4th St., Tucson, AZ 85719

The 1944 Water Treaty allocates the Colorado River flows through seven basin states (97% of the basin is in the U.S. and is comprised of Wyoming, Colorado, Utah, New Mexico, Nevada, California, Arizona) and Mexico. Under the 1944 Water Treaty, the United States is required to provide Mexico with 1.5 million acre-feet (AF) of Colorado River water annually. The Minute 319 Agreement stated that 130 million cubic meters of water was to be released during the spring of 2014. It was released from Morelos Dam near Yuma, AZ on the lower Colorado River, to the river's delta in Mexico, allowing water to reach the Gulf of California for the first time in 13 years. Our study examined the effects of this 2014 binational pulse-flow experiment on vegetative response along the riparian corridor. We used the years 2000-2013 before the 2014 water release to look at pre-pulse flow greenness and evapotranspiration (ET), then we looked at the post-pulse flows from 2014 through 2018. With nearly five years since the Minute 319 water was released, we were able to assess the post-pulse changes in vegetation greenness and evapotranspiration (ET). We used 250 m Moderate Resolution Imaging Spectroradiometer (MODIS) and 30 m Landsat 8 satellite imagery to track ET and the normalized difference vegetation index (NDVI; a measure of greenness which is scaled between images used and year to year and becomes NDVI*). Our analysis showed an overall increase in NDVI and ET in 2014 (year of the pulse), which reverses a decline in those metrics since the last major flood in 2000. NDVI and ET levels decreased in 2015, but were still significantly higher than pre-pulse (2013) levels. This declining trend has persisted into 2018 with lower than pre-pulse values in all reaches MODIS EVI time-series data for these reaches also shows a declining trend after 2015. We illustrate our results with NDVI change maps developed from Landsat data for seven river reaches in the delta. We continue to analyze results for 2018 and will compare these findings to short term (2013-2018) and long-term (2000-2018) changes in NDVI and ET. Our results support the conclusion that the Minute 319 pulse had a positive but short-lived impact on vegetation growth in the delta.