

An Accounting System for Water and Consumptive Use Along the Colorado River, Hoover Dam to Mexico

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Abstract

An accounting system for estimating and distributing consumptive use of water by vegetation to water users was developed for the Colorado River from Hoover Dam to Mexico. The accounting system is based on a water-budget method to estimate total consumptive use by vegetation from Hoover Dam to Morelos Dam. Consumptive use by vegetation is apportioned to agricultural users by using percentages of total evapotranspiration by vegetation estimated for each diverter of water. Evapotranspiration for each diverter is estimated from (1) digital-image analysis of data from the Landsat satellite to determine vegetation types and areas for each diverter and (2) water-use rates to determine the quantity of water used by each vegetation type. Evapotranspiration is estimated for each of four reaches of the river--Hoover Dam to Davis Dam, Davis Dam to Parker Dam, Parker Dam to Imperial Dam, and Imperial Dam to Morelos Dam--to incorporate spatial variations in the weather data used to calculate water-use rates.

The Lower Colorado River Accounting System was used to estimate and distribute consumptive use by vegetation in calendar year 1984; consumptive use by vegetation was 2,069,900 acre-feet. About 4,283,200 acre-feet of water was exported to California, 391,400 acre-feet was diverted to the Wellton-Mohawk area in Arizona, 1,358,100 acre-feet was used for agriculture in the flood plain of the Colorado River, 1,055,800 acre-feet was transpired by phreatophytes or evaporated from open-water surfaces along the river, and 40,600 acre-feet was consumed by domestic and municipal users in and adjacent to the flood plain. Total water loss from the Colorado River in the United States below Hoover Dam during 1984 was about 7,129,100 acre-feet. About 18 percent was consumptively used in Arizona, 67 percent in California, less than 1 percent in Nevada, and about 15 percent was used by phreatophytes or evaporated from open-water surfaces.

The accounting system produced reliable (less than 1 percent difference from the previous method) results for 1984 when, because of an unusually large quantity of flow in the river, the computed consumptive use by vegetation was less precise than anticipated. On the basis of the analysis for 1984, the accounting system should yield accurate estimates of consumptive use by agricultural users for all years. To improve the estimate of consumptive use by vegetation, errors in computed flow at the mainstream gages should be further reduced. More accurate computation of discharge at the major dams along the Colorado River will also facilitate the use of water budgets for subreaches of the river to refine the estimates of consumptive use by vegetation along the river. Water-use rates for vegetation types that more accurately reflect spatial and temporal variability of evapotranspiration need to be developed to improve the distribution of consumptive use by vegetation; the identification of minor crops and multiple-cropped areas also needs to be improved.