# Tamarisk Seasonal Evapotranspiration Estimates using High-Resolution Airborne Remote Sensing

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This presentation describes the application of a high resolution multispectral and thermal infrared imagery to obtain the evapotranspiration of Tamarisk and native vegetation present along approximately 90 miles of the Mojave River floodplain and riparian zone. The Mojave River is located in Southern California in a hot desert climate. The Mojave River Water Agency would like to better understand the impact that invading Tamarisk has on surface and ground water resources under their control.

The airborne multispectral imagery and LiDAR data were acquired at the end of June, 2010 over a 2 day period, under clear sky conditions using the USU airborne multispectral digital system which is now integrated with USU's LASSIE LiDAR system. The multispectral imagery (0.35 m pixel resolution) was ortho-rectified using the LiDAR data and a direct geo-referencing technique. The thermal infrared imagery (1-meter pixel resolution) was rectified to the multispectral ortho-mosaics using common control points. Both the multispectral imagery and thermal infrared imagery were calibrated using the MODTRAN atmospheric transmission model and system calibration curves.

The multispectral imagery was classified using the E-cognition software and ground-truthed using a combination of ground field visits and helicopter video surveys. The calibrated imagery was used for estimating evapotranspiration (ET) of the vegetation using two different models, namely the SEBAL model and the Two Source Model. ET statistics were extracted from the results and compared according to Tamarisk canopy closure density class and vegetation type obtained from the image classification. Both models performed satisfactorily with similar Tamarisk ET results to those measured at the Cibola National Wildlife Refuge in the Lower Colorado region. Daily estimates for alfalfa and grass ET present in the airborne imagery were also reasonable.

Yearly estimates were obtained by extrapolating the daily results to seasonal values using a generalized vegetation ET curve ("crop" coefficient) and reference evapotranspiration estimated from weather data collected at a local CIMMIS station.

Results show that Tamarisk uses less water than alfalfa, grass and cottonwood, but more than other vegetation types that it is replacing in the floodplain such as Mesquite and desert shrubs. Depth to groundwater may have an impact on Tamarisk density, variability and water use. The LiDAR data are being used to update the depth to groundwater maps so its effect can be studied spatially vis-à-vis Tamarisk canopy closure density. LiDAR data was also used to get the height of the vegetation in the riparian zone.