Water Quality and Riparian Ecosystem Monitoring in the Impaired Waters of the Verde River Utilizing Drone Technology

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Drone technology can help assess water quality and riparian habitat health both in real time and with long-term data collection. The Verde Valley saw an 82% increase in population from 1999-2015 and hosts over 4 million tourists annually. This population increase is putting pressure on watershed levels in two ways: 1) water consumption and 2) habitat health due to the popularity of recreational activities on the river. The method used demonstrates the capability for drones to collect water samples via an apparatus attachment along a 20-mile stretch of impaired water of the Verde River. The drone allows for field technicians to sample 10-12 sites in a three-hour window with minimal human disturbance and sample contamination via sediment upheaval. Using this technology has allowed for an increase in samples collected annually in this region with over 650 data points compared to 15 data points before drone use. Temperature, pH, dissolved oxygen, total dissolved solids, and turbidity were measured for the selected sites and were analyzed for *E. coli* to assess human health risks. Riparian zones with increased urbanization and runoff had exceedance levels of *E. coli* greater than 235 MPN/100mL (most probable number), which are exceeding the national standards for full body contact in recreational waters. In addition automated flight routes can also track topographical and vegetative changes of the ecosystem immediately following monsoon events, dam removals, and irrigation ditch installations. This combination of photogrammetry capabilities and greater accessibility for sampling makes drone technology an effective method for collecting baseline data, and provides open source data for researchers and stakeholders such as Arizona Game and Fish and the Arizona Department of Environmental Quality to preserve the Middle Verde River.