Spatial and Temporal Changes of Effluent-Dependent Waterways in Arizona

Margaret White
Arizona State University - School of Life Sciences

ABSTRACT

Flow regimes of riparian ecosystems in southwestern United States have been altered by many anthropogenic actions. A new hydro-dynamic is emerging as water consumption for growing urban development is increasing effluent generation. We present information on changing spatial patterns of effluent discharge in Arizona since the mid-twentieth century based on historic aerial photography and data from treatment facilities and state agencies (e.g. ADEQ). We also discuss potential future changes to discharge patterns and effects on riparian ecosystem development. Preliminary data indicate the existence of 60 point sources of municipal effluent production discharging at 90 outfalls. The fate of the effluent varies widely. Some is used to create riparian/wetland habitat re-used or released into surface water bodies or aquifers to sustain riparian habitat. Of the portion released into river channels approximately three-quarters flows into ephemeral channels and as of 2002 36 waterways in Arizona had been officially designated as effluent-dependent. Effluent-sustained waterways are fundamentally different from both dry or intermittent streams and naturally perennial rivers because the discharged wastewater is nutrient rich and steadily released fluxing diurnally with urban consumption patterns and often remaining disconnected from the floodplain aquifer. The consequences of effluent discharge for riparian ecosystems vary depending on hydrogeomorphic traits of the receiving stream. For example data for the effluent-sustained lower Santa Cruz River characterized by a wide dynamic floodplain and deep aquifer indicate that the pioneer forests are younger and more willow-dominated than along a sister river (San Pedro). Effluent discharge also is altering patterns at larger landscape scales by creating many short perennial stream reaches within a watershed. Over the coming decade both the number of municipal discharge points and the total discharge is expected to increase substantially increasing the urgency of understanding ecological implications of effluent discharge.