Water Resources Research Center
The University of Arizona

Annual Technical Report
2018

General Information

Products

Dwivedi, R., 2019, An Improved Understanding of Ecohydrological and Geochemical Functioning of a Mountainous Site Using Multiple Methods and Multiple Tracers, PhD Dissertation, Department of Hydrology and Atmospheric Sciences, University of Arizona, Tucson, Arizona, 259 pp.

Dwivedi, R., T. Meixner, J.C. McIntosh, P.A. Ferre, C.J. Eastoe, G-Y. Niu, R.L. Minor, G.A. Barron?Gafford, J. Chorover, 2019, Hydrologic functioning of the deep critical zone and contributions to streamflow in a high?elevation catchment: Testing of multiple conceptual models, Special Issue: Water in the Critical Zone, Hydrological Processes, (33) 746-494.

Eden, S., Petersen-Perlman, J.D., Hermosilla, V., and Golden, J., 2018, The Business of Water, The Water Report, https://www.thewaterreport.com/.

Lynch, R., 2018, Might Recycled Water Inhibit Toxin-Producing Cyanobacteria? MS Thesis, Department of Soil, Water and Environmental Science, College of Agriculture and Life Sciences, University of Arizona, Tucson, Arizona, 70 pp.

Megdal, S.B., 2018, Learning About Water Policy, Arizona Water Resource, 26 (1), https://wrrc.arizona.edu/public-policy-review-learning-about-water-policy.

Megdal, S.B., 2018, The Business of Water is Everyone's Business,, Arizona Water Resource 26 (2), , https://wrrc.arizona.edu/public-policy-review-business-of-water.

Megdal, S.B., 2018, Reflections on Change and Continuity in WRRC Outreach, Arizona Water Resource, 26(3), https://wrrc.arizona.edu/reflections-and-change-continuity-wrrc-outreach.

Megdal, S.B., 2018, Looking Back . . . Past Columns Shed Light on Current Issues, Arizona Water Resource, 26(4), https://wrrc.arizona.edu/looking-back-past-columns-shed-light-current-issues.

Information Transfer Program

Between March 1, 2018 and June 30, 2019, WRRC's Information Transfer Program included events, publications, and electronic communication. WRRC personnel made 100 presentations and produced 30 publications. Student PIs on the104B research projects gave six presentations.

More than 330 people attended the 2018 Annual Conference, "The Business of Water", and approximately 350 attended the 2019 Annual Conference, held February 1, 2019, including US Sen. Martha McSally and five Arizona legislators. The WRRC's Brown Bag seminar series offered 27 presentations on a wide range of water topics. Off-site Go-To-Webinar participation approximately doubled attendance, and more accessed webinar recordings and slides later through the website.

During the reporting period, WRRC published 47 editions of the Weekly Wave/Summer Wave e-news digest and its Constant Contact distribution list increased by 333 recipients to 2,752. The Weekly Wave email's average open rate is 33 percent, a top tier score.

Two Arroyos, WRRC's unique annual publication, were published, in May 2018 and June 2019, and distributed to approximately 3,500 email and print subscribers. These 16-page publications discussed Arizona's irrigated agriculture and the business of water. Two major Arizona agricultural associations handed out the Arroyo on irrigated agriculture at their respective 2018 annual conferences.

Four issues of WRRC's quarterly newsletter, Arizona Water Resource (AWR), were published electronically in 2018, its final year of publication. All AWRs are posted on the WRRC website. The WRRC website expanded its viewership by 23 percent in 2018, and website users numbered 50,339, a 14 percent increase over the 2016-2017 project year.

Student Support

four (4) undergraduate students, one (1) PhD student

Notable Achievements and Awards

PhD student Drew Eppehimer (2018AZ584B) won the Carl L. Hubbs Award for student presentation, Desert Fishes Council annual meeting 2018.

This study (2018AZ587B) advanced progress toward deployment of a simple, efficient, low-cost technology for removing lead from drinking water. Lead does not break down to less toxic chemical forms, thus remediation for health and safety requires removal. the study identified Spirulina as a promising algal species, or algal consortium, for lead removal. Spirulina, which is common and easily cultivated, is capable of reducing aqueous lead concentrations by 95%-99% when fixed in an algae-modified filter.

Projects

Microplastic Contamination in the Lower Santa Cruz River

Project Type: Annual Base Grant **Project ID:** 2018AZ584B

Project Impact: Microplastics are an emerging contaminant of potential ecological concern in waterbodies across the world. In this project, we quantified microplastic concentrations in the water column, benthic sediment, and mosquitofish stomachs at 10 sites along the effluent-dependent Santa Cruz River in Tucson, AZ. We also compared microplastic concentrations before and during the monsoon season. Microplastic fibers, fragments, film, and beads were found in samples from the Santa Cruz River. Across all sites, microplastic concentration in the water column was ~33% higher during the monsoon, with the majority of pieces (?80%) being fibers in both seasons. Microplastic concentration in benthic sediment was nearly twice as high before the monsoon season (340 ± 54 No./Kg) than during the monsoon season (153 ± 21), with fibers and fragments being the most common types of plastic found in sediment. Before the monsoon season, only three of the 200 mosquitofish sampled had ingested microplastics (100% fiber). In contrast, microplastics (85% fiber, 10% film, 5% fragment) were found in 20 of 200 fish sampled during the monsoon season. Finally, the concentration of microplastic fibers in the water column during monsoon increased linearly downstream across the 10 sampling sites. This project provides the first evidence that microplastics are common in the water column and sediment of the Santa Cruz River in Tucson, and that mosquitofish are more likely to ingest microplastics during the monsoon season. Future studies should assess the long-term impacts of these microplastics on the health and populations of aquatic species. Eppehimer, Bogan & Quanrud

Using freshwater algae to remove lead from water

Project Type: Annual Base Grant **Project ID:** 2018AZ587B

Project Impact: Lead is a known neurotoxin and has been linked to diminished IQ and serious health problems, affecting millions of people worldwide through natural and anthropogenic contamination of drinking water. The recent cases of lead in municipal drinking water have emphasized the critical need for remediation from potable water. This undergraduate-driven project investigated phytoremediation of lead from drinking water using the common freshwater algae Spirulina. Results showed that wet algae packed on filter paper can remove 95% - 99% of lead at environmentally relevant concentrations of 207 ?g l-1 for a 10 ml volume passed through 0.5 g of biomass loaded on glass fiber filter. A series of increasingly aggressive and targeted chemical extractions investigated the sequestration mechanisms. The first wash, deionized water targeting non-specifically adsorbed lead, removed 1.6% of the retained lead, a second wash of MgCl2 targeted exchangeable Pb2+ removed 70 % of the sequestered lead was robustly bound and not extractable. To examine the binding mechanism, synchrotron X-ray absorption spectroscopy was used to determine the atomic species. The lead in algae was confirmed to have a molecular (ligand) interaction with algae, determined to be 70% between Pb2+ and CO32- and 30% Pb2+ and PO43-. This work examined the control of a serious water quality problem using renewable natural resources. Minke, Root, Cuello, McLain & Chorover