School of Sustainability
Arizona State University

In Partial Fulfillment of the Requirements for the Degree of

Master of Science

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Will defend her thesis

Monitoring Algal Abundance and Water Quality in Arizona Reservoirs Through Field Sampling and Remote Sensing

Abstract

Safe, readily available, and reliable sources of water are an essential component of any municipality's infrastructure. Phoenix, Arizona, a southwestern city, has among the highest per capita water use in the United States, making it essential to carefully manage its reservoirs. Generally, municipal water bodies are monitored through field sampling. However, this approach is limited spatially and temporally in addition to being costly. In this study I test the application of remotely sensed reflectance data from Landsat 7's Enhanced Thematic Mapper Plus (ETM+) and Landsat 8's Operational Land Imager (OLI) in addition to data generated through field-sampling, to gain a better understanding of the seasonal development of algal communities and levels of suspended particulates in the three main terminal reservoirs supplying water to the Phoenix metro area: Bartlett Lake, Lake Pleasant, and Saguaro Lake. Algal abundances, particularly the abundance of filamentous cyanobacteria, increased with warmer temperatures in all three reservoirs and reached the highest comparative abundance in Bartlett Lake. Prymnesiophytes (the class of algae to which the toxin-producing golden algae belong) tended to peak between June and August, with one notable peak occurring in Saguaro Lake in August 2017 during which time a fish-kill was observed. In the cooler months algal abundance was comparatively lower in all three lakes, with a more even distribution of abundance across algae classes. Also, in-situ data from March 2017 to March 2018 were compared with algal communities sampled approximately ten years ago in each reservoir to understand any possible long-term changes. My findings show that the algal communities in the reservoirs are relatively stable, particularly those of the filamentous cyanobacteria, chlorophytes, and prymnesiophytes with some notable exceptions, such as the abundance of diatoms, which increased in Bartlett Lake and Lake Pleasant. When *in-situ* data were compared with Landsat-derived reflectance data, I found that two-band combinations were the best-estimators of chlorophyll-a concentration (as a proxy for algal biomass) and total

suspended sediment concentration. The ratio of the reflectance value of the red band and the blue band produced reasonable estimates for the *in-situ* parameters in Bartlett Lake. The ratio of the reflectance value of the green band and the blue band produced reasonable estimates for the in-situ parameters in Saguaro Lake. However, even the best performing two-band algorithm did not produce any significant correlation between reflectance and in-situ data in Lake Pleasant. Overall, remotely-sensed observations can significantly improve our understanding of the water quality as measured by algae abundance and particulate loading in Arizona Reservoirs, especially when applied over long timescales.

Monday, July 2, 2018
10:00 AM
Wrigley Hall, Room 481

Faculty, students, and the general public are invited.

Supervisory Committee:
Dr. Susanne Neuer, chair
Dr. Peter Fox, member
Dr. Soe Myint, member