DELTA SCIENCE FELLOW 2016

Delta Stewardship Council
Delta Science Program

Sea Grant California

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WHY THIS RESEARCH MATTERS

Each year, millions of dollars are spent in the Delta to prevent invasive weeds from obstructing navigation, reducing water quality, displacing native species and harboring mosquitoes.

Biological control of aquatic weeds by insects – a promising means of mitigating these weeds – is not performing as well as expected. One reason for this may be the high levels of pesticides or fertilizers in the Delta waters, which are largely influenced by runoff from upstream agriculturally intensive watersheds.

Modeling pesticide loadings into the Sacramento-San Joaquin Delta: potential impacts on weed biological control

Though it appears to be a lush blanket of ground cover, the floating water hyacinth is an invasive species that obstructs water conveyance. Here, it chokes the intake channel for the C. W. Bill Jones pumping plant at the southern end of the Sacramento–San Joaquin Delta. *Bureau of Reclamation by CC BY-SA 2.0*

PROJECT

In this project, Chen used a model known as the Soil and Water Assessment Tool to model streamflow, sediment discharge, pesticide dynamics, and nitrogen loading in the San Joaquin River watershed. In the first year of the project, Chen modeled the loading of diuron, a frequently detected pesticide, and analyzed its potential impacts on biocontrol agents. In the second year, Chen applied the model to simulate nitrogen dynamics in the river to understand how fertilizer application and tile drainage systems may influence downstream aquatic weed growth.

RESULTS

Chen successfully applied a spatially distributed, physically based hydrologic model to the San Joaquin watershed, which is about 15,000 km^2 and largely agricultural. Modeling results provided a quantitative understanding of diuron loading into the Delta, and the uncertainty of model estimates was quantified. The research showed that in fact, the majority of agricultural diuron transport—over 70%—occurred during winter months, when insects that act as biological control agents are dormant.

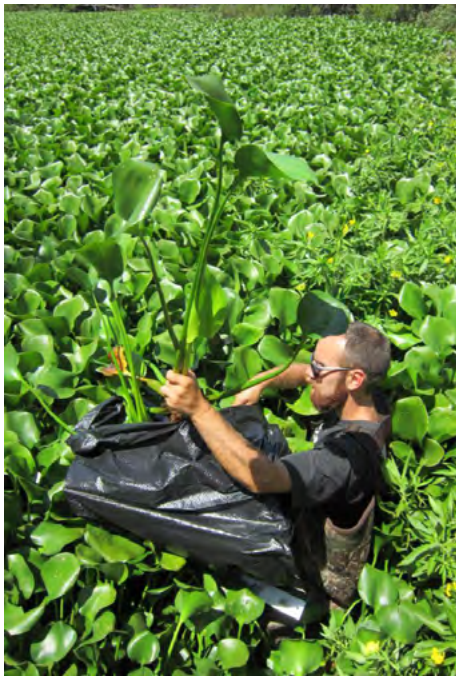
Using the model that she had set up and calibrated to understand diuron transport, Chen adapted the model to simulate nutrient loading, another potential cause of aquatic weed growth. Based on the results of this work

RESULTS (continued)

and California Fertilization Guidelines, and in consultation with farm advisors, Chen developed a fertilizer application schedule in the San Joaquin River watershed as model input. Preliminary results of the modeling show that tile drainage nitrate was a significant contributor to the nitrate loads in the San Joaquin River. The calibrated model was able to track nitrate dynamics in the San Joaquin River reasonably well based on standard evaluation criteria.

MANAGEMENT APPLICATIONS

The study results are being used by the United States Department of Agriculture (USDA) Delta Region Areawide Aquatic Weed Project, informing decisions about aquatic weed control throughout the watershed. A key goal of the project is adaptation of watershed-scale water quality models within an integrated modeling system to allow the assessment of pesticide and nutrient impacts on aquatic weed growth. The output generated from Chen's modeling work could support downstream aquatic weed growth models with important water quality parameters such as nitrate loads in the water entering the Delta. The study also provides a better understanding of streamflow and sediment dynamics, useful for researchers and water managers working to better understand the movement of pesticides and nutrients towards Delta waterways.



A technician samples the water hyacinth in the Delta. Understanding the response of these aquatic plants to changing environmental conditions in the Delta may yield insights into tailoring management for improved control. *J. Madsen*

PUBLICATIONS AND PRESENTATIONS

Chen H, Luo Y, Potter C, Moran PJ, Grieneisen ML, Zhang M. 2017. Modeling pesticide diuron loading from the San Joaquin watershed into the Sacramento-San Joaquin Delta using SWAT. *Water Research* 121. 15 September 2017, pp 374-385.

Chen H, Luo Y, and Zhang M. 2017. Modeling pesticide loadings from the San Joaquin watershed using SWAT. Oral Presentation at the American Chemical Society National Meeting, San Francisco, CA. April 6 2017.

Chen, H and Zhang M. Modeling pesticide loadings from the San Joaquin watershed into the Sacramento-San Joaquin Delta using SWAT. Oral presentation at the America Geophysical Union Fall Meeting, San Francisco, CA. December 2016.

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