M.L. 2013 Minnesota Aquatic Invasive Species Research Center Subproject Abstract
For the Period Ending June 30, 2019

SUBPROJECT TITLE: MAISRC Subproject 8: Risk assessment, control, and restoration research on aquatic invasive plant species
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LEGAL CITATION: M.L. 2013, Chp. 52, Sec. 2, Subd. 06a

SUBPROJECT BUDGET AMOUNT: $822,000
AMOUNT SPENT: $820,251
AMOUNT REMAINING: $1,748

Sound bite of Subproject Outcomes and Results
This project predicted invasion risk, assessed ecological impacts, evaluated control efficacy, and investigated factors limiting post-control recovery of native aquatic plants. This was applied to starry stonewort, Eurasian watermilfoil, and curlyleaf pondweed. This will refine approaches for invasion prevention, reduce populations of established AIS, and restore native species.

Overall Subproject Outcome and Results
Aquatic invasive plants can lower native plant diversity, reduce habitat quality for fish and other animals, and interfere with recreation. To protect Minnesota's water resources, steps need to be taken to prevent new invasions, control existing populations, and support recovery of native biodiversity. These efforts require sound, science-based guidance. To provide such support, we conducted research to predict invasion risk, assess ecological impacts, evaluate control efficacy, and investigate factors limiting post-control recovery of native aquatic plants. This work was applied to three target species at different stages of invasion: (1) *Nitellopsis obtusa* (starry stonewort), first found in Minnesota in 2015 and now known in 14 lakes; (2) *Myriophyllum spicatum* (Eurasian watermilfoil), found in 1987 and established in >300 lakes; and (3) *Potamogeton crispus* (curly-leaf pondweed), here for >100 years and in >750 lakes. For starry stonewort, we developed models to predict risk of further spread and prioritize search locations for statewide volunteer search efforts, experiments to determine how long starry stonewort remains can survive out of water (i.e., remain transportable by boaters), and field and lab-based control experiments to guide management. For Eurasian watermilfoil and curly-leaf pondweed, we investigated relationships with native plant biodiversity, finding that they displace native species, an effect compounded by lower water clarity, and contribute to "biotic homogenization"—loss of ecological distinctiveness. We are investigating how to better control these invasive species and foster recovery of native vegetation by synthesizing thousands of aquatic plant surveys and management records collected in Minnesota and by conducting in-lake removal and restoration experiments. This work will continue under a follow-up project (MAISRC Subproject 8.2: Impacts of invader removal on native vegetation recovery). Our findings help Minnesotans by highlighting practices needed to protect lake ecosystems and refining approaches for preventing invasions, reducing populations of established AIS, and restoring native species.

Subproject Results Use and Dissemination
Information from this project has been disseminated through 10 peer-reviewed journal articles, 30 invited talks, 20 contributed presentations, 45 media stories, and resources published on the MAISRC website. Fully published

articles (7 of the 10) are included as attachments. Project findings are being used to guide AIS spread prevention and management efforts involving the Minnesota Department of Natural Resources, lake associations, and other stakeholders. This project has also contributed significantly to MAISRC Subproject 10 ("Citizen Science and Professional Training Programs to Support AIS Response").