

4th World Congress and Expo on

Applied Microbiology

September 19-21, 2016 Las Vegas, USA



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Predicting the distribution of an invasive algae across the Rocky Mountains from environmental DNA and remote sensing data

Natural resource managers must often make decisions that potentially impact freshwater species but they have very limited information on where these species occur. This lack of information can potentially lead to management actions either inadvertently spreading invasive species or harming threatened and endangered ones. We demonstrate the potential of combining environmental DNA (eDNA, DNA released from an organism into the environment), existing data on species presence/absence and remote sensing observations to predict distribution of an aquatic invasive diatom, *Didymosphenia geminata*. eDNA provided a single sample detection probability of 80%, a 30% increase over traditional methods in less time and at lower cost. To predict probabilities of species occurrences at unsampled locations, we used a combination of eDNA and traditional survey data to develop species distribution models (SDMs). Five of the SDMs we developed predicted known occurrences of *D. geminata* at new sites across the Rocky Mountains with greater than 93% accuracy. Predictors used by these SDMs included remotely sensed satellite measurements of evapotranspiration, temperature and vegetation, water chemistry model predictions and other spatial data. The best predictions were made by models that included temporally specific measurements of evapotranspiration linked to inter-annual differences in precipitation. We then applied these models to map *D. geminata* probabilities of occurrence at individual stream reaches across the Rocky Mountains suitable for management use. This approach could be applied to other freshwater species of concern to management, providing high resolution data needed for informed management decisions.

Biography

John Robert Olson has completed his PhD in Watershed Science from Utah State University and Postdoctoral studies at the Desert Research Institute. He is currently an Assistant Research Professor at the Desert Research Institute, specializing in understanding how landscape patterns in geology, climate, vegetation and other environmental factors affect surface water chemistry and how differences in water chemistry in turn affect stream biota.

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