Predicting Potential Effects of Global Climate Change on Invasive Species Distributions

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Anticipated changes to temperature and precipitation associated with climate change can be combined with knowledge of current species distributions and key factors related to biotic response, to predict future distributions of invasive species. We describe general aspects of climate change, important biological factors, various models used to make predictions of future change, and exciting areas of current and future research. Scientists at the USGS, National Institute of Invasive Species Science have developed a web-based framework for integrating species distribution information from a variety of sources with current and predicted changes in temperature, to predict potential future distributions. Several modeling approaches are being used (e.g., GARP, CART, logistic regression, environmental envelope), and have been applied to a broad range of organisms, including various aquatic taxa. At regional and local scales within river systems of the western U.S., mechanistic models are being developed to quantify temperature and streamflow variables that drive the distribution of native and invasive woody riparian vegetation in the 17 western states. For the widespread, high profile invasive riparian shrub, tamarisk, we have also done work examining its cold tolerance, and its ability to evolve and potentially migrate in response to warming temperatures. Riparian ecologists at USGS are also working closely with hydrologists and academic collaborators to develop mechanistic models to link predictions of the effects of climate change on streamflow magnitude and timing, phenology, and the responses of key invasive riparian and aquatic species associated with rivers in arid and semi-arid western USA (e.g., tamarisk, New Zealand mud snail), in the important context of water management.